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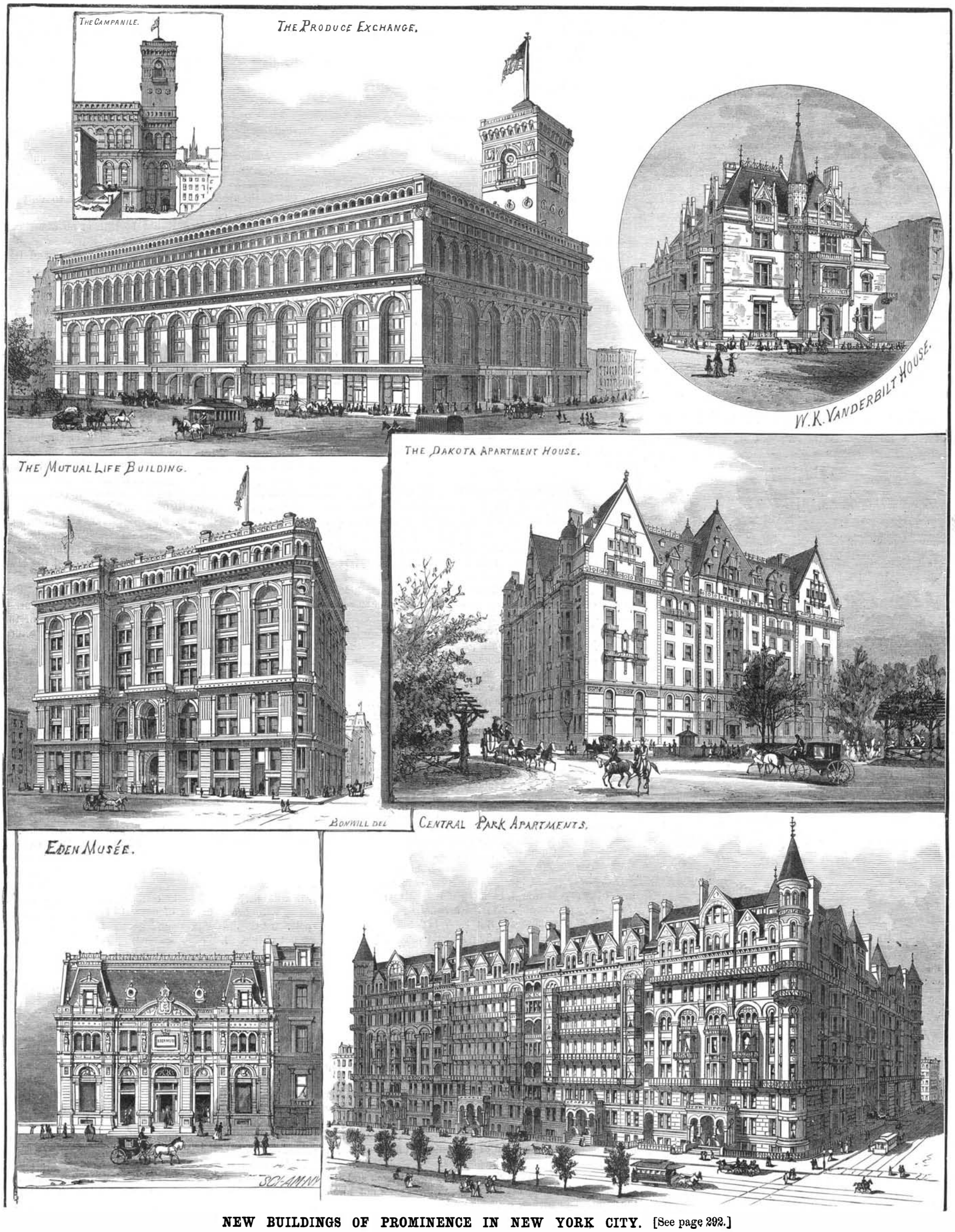

NEW BUILDINGS OF PROMINENCE IN NEW YORK CITY. [See page 292.]

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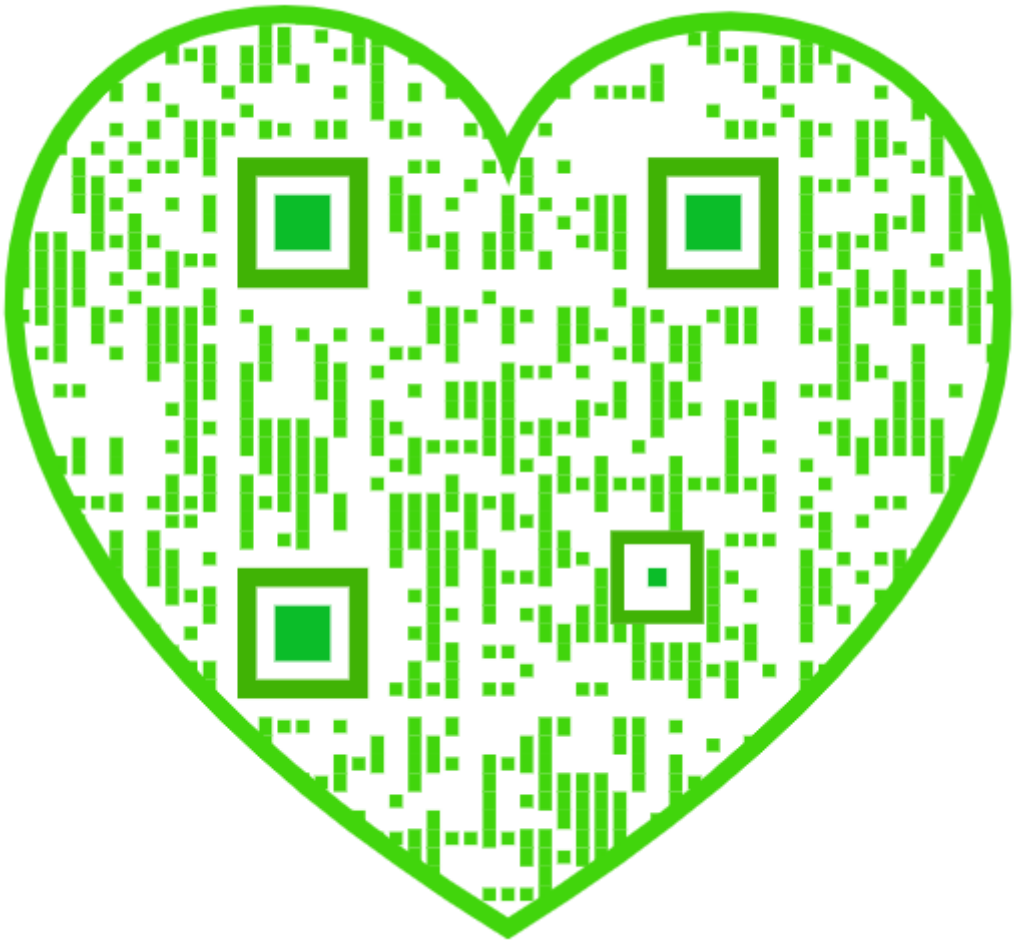

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PATENTS TO FOREIGNERS.—GOVERNMENT PURCHASE OF PATENTS.

Senator James C. George, of Mississippi, has introduced the following resolution, which on motion was referred to the Patent Committee:

"*Resolved*, That the Committee on Patents be instructed to report a bill to prevent hereafter the granting of any patent for any invention or discovery made by any person not at the time of such invention or discovery a citizen and resident of the United States; and the committee is further instructed to inquire into the expediency of providing by law that all patents hereafter granted shall be subject to purchase by the United States for the public use, upon a fair valuation thereof."

By industry we thrive. The object of the law in granting patents to foreigners is to encourage the multiplication and prompt introduction of new industries. What matters it where the residence is of the author of a new and gigantic industry like the Bessemer steel process, from which the nation has already derived many millions of dollars of profit, and thousands of millions are still to follow? Is it generous, is it good policy, to deny to such inventors the pittance of a patent certificate, by means of which, during a short period of 17 years, they may, if they work hard, perhaps realize a small personal reward? We think not.

Mr. George believes that the law should be changed so that patents may be taken at any time, by payment from the national treasury, and made free to the public.

As the law stands, all patents become free to the public at the end of 17 years from date—a period so brief that it is a mere dot in the time-history of a great nation. The reaper and mower, the planing machine, the turning machine, the sewing machine, the electric telegraph—hundreds of other great inventions might be named—all have become free to our people by operation of the present law. It does not seem as if Senator George's proposed law would be an improvement. Take the telephone patent, for example. A low present valuation, perhaps too low to be fair, would be three hundred millions of dollars. The patent has nine years to run. It must be confessed the public is now pretty well served by the telephone owners. Would it be of advantage to the people now to pay three hundred millions of dollars from the Treasury to extinguish a patent that will so soon expire? We doubt it.

The present law provides for the acquisition by the public of all patents that may hereafter be granted on terms much more convenient and at far less cost, we think, than the system proposed by the honorable Senator from Mississippi.

A SUGGESTION AS TO OVERHEAD WIRES.

What shall be done with the wires which, like threads of a huge web, hold the New York streets in a mesh-like tangle, is a question as perplexing as it is important.

The Board of Aldermen says that such of them as pertain to electric lighting plants must be buried after May, 1885; one branch of the Legislature says that both electric light and telephone wires must be underground by June 1, 1885, in cities of 50,000 inhabitants or over. Lastly, the sub-committee appointed by the representatives of the electrical companies, exclusive of Western Union, after considering the subject for several months, have decided that wires of all descriptions should go underground, and suggest that the municipality provide suitable subways for their reception. Singularly enough, neither the Legislative investigating committee nor yet that appointed to represent private interests considered what would seem to be by far the most important point bearing upon the subject in hand, viz., the convenience of the general public.

No reasonable person will deny that electric mains carrying powerful and dangerous currents should be placed out of reach. But telegraphic and telephonic wires are dangerous neither to life nor property, and so far as they are concerned the question would seem to be: Is their unsightliness and the annoyance attendant upon their repair of more importance to the general public than the additional expense of their use which it is but reasonable to look for when the costly subways and tunnels shall have been built?

If the telegraph and telephone were only for the rich, that is, for the few, it would be neither surprising nor illogical if the many should object to the invasion of the streets and the roofs of their houses. But such is not the case. Both services have become generally popular, and already so much used as to have become almost a necessity.

So far as the telegraph is concerned, the public is looking forward to a very decided reduction in the rates, and, considering the conditions under which the service is performed to-day, there seems to be no reason why they should not be gratified. But if no one is willing to be the least inconvenienced for the sake of the general welfare, if no one is willing to have a wire pass his door or cross his roof, he may not reasonably expect at the same time to have a cheap service.

It is much the same with the telephone. Increase the expenses of the companies, and you force them to increase their rates for service. This tends, as a natural consequence, toward limiting its usefulness, for no matter how convenient it may be in the transaction of the ordinary affairs of life, it cannot, if it be expensive, be popular.

If a man objects to the clatter of the milk wagon and the baker's wagon before his door, he can, if he does not mind the additional expense, have his milk and bread brought to him by hand. But it would be manifestly unfair and unreasonable to expect that his less fortunate neighbors should incur a like expense that he might not be disturbed. Equally absurd would it be, should he expect his milkman and baker to go to the additional trouble of serving him by special messenger at the same rates, and still worse, to even demand a reduction in these. The fact is, every one should be willing to sacrifice something for the general welfare. With this view, it would seem as though a plan might be devised by which the telegraph and telephone wires could be systematically led over the roofs of the houses, without proving a special hardship or annoyance to any one; and we must confess it seems somewhat surprising that no such plan has, so far as we know, been considered. There is good reason to believe that, with proper supervision by constituted authorities, the general and indiscriminate scrambling over roofs, now indulged in by line men, could be avoided in great measure. The unsightly street poles could be done away with, and the wires now strung on them be laid in the same order over roofs of the houses. When damage of any kind resulted, such as injury to a chimney or roof, those who had general supervision over all the wires could readily decide who was responsible for it, and hence who must repair the injury done.

Nor is it by any means certain that the construction of subways through the main thoroughfares would, though increasing the cost of service, abate the alleged nuisance of stringing the wires over the houses. Telephones and burglar alarms are usually run over the tops of the houses and across the yards and courts, and unless all the side streets, as well as the avenues, were undermined, and so unnecessary and costly an undertaking has not, we believe, even been contemplated, there would be little or no diminution in the number of wires crossing the roofs.

In the plan we have suggested, the telephone and telegraph wires could readily be kept apart, as indeed could the lines of the various companies.

What most commends this plan is its cheapness and convenience, which characteristics, if we mistake not, are the essentials to every scheme in which the general public is looked for to take part.

The public demands cheap telegraph and telephone service, and that this may be had by any of the recent plans to sink the wires, we must in candor confess there are grave doubts.

THE MAXIMUM OF SUN SPOTS.

The sun is behaving in a strange fashion, and refuses to obey the laws laid down for him by terrestrial observers in regard to his spot producing activity. As is well known, the sun's spot cycle is completed in a little more than eleven years. For two or three years the spots are larger and more numerous, and continue so until the cycle has reached its maximum. They then begin to diminish, and in five or six years reach the minimum; the passage of another six years brings the return of the maximum, and completes the cycle. The intervals are, however, irregular, and the laws of the period are not determined with certainty.

The present irregularity is beyond the usual bounds, and is unaccountable. The last maximum of sun spots occurred in 1870, and the last minimum in 1878. The return of the maximum was, therefore, looked for in 1882, and the return of the minimum is expected in 1889. But the agitation of the solar surface did not diminish in 1883, and the activity continues thus far in 1884.

Astronomers who make solar physics a specialty are hard at work in the effort to find out the cause of this anomalous proceeding on the part of the great day star, and several of them have come to conclusions at variance with each other, as is the case in most theories about the sun.

M. Faye, the distinguished French astronomer, reports as the result of his close observation that the solar activity is actually decreasing. He thinks that the number of days when the sun was free from spots was greater in 1883 than it was in 1882; that the number will be larger in 1884; and that the increase will be still more rapid in 1885, 1886, and so on, until the minimum is reached in 1889. This careful observer is confirmed in his view of the question from the conclusions reached by Schwabe, who systematically observed the sun during a large part of a long life. He determined the periodicity, not by counting the number of spots, but by noting the number of days the sun was free from spots. At the maximum there is scarcely a day when spots are not visible. After its passage there are occasional days when the sun's face is unmarred, the number increasing until the minimum is reached, when the sun is clear of spots for nearly half the year, oftentimes for many days in succession.

M. Wolf, of Zurich, is the renowned astronomer who, making use of the observations of Schwabe, traced back the periodicity to the time of Galileo, and proved its existence beyond a doubt. He partially agrees with M. Faye. According to Wolf's observations, the average of the relative number of spots is greater in 1883, but the greatest monthly average is found in 1882. The number of days without spots is four times greater in 1883. M. Wolf thinks that, with our present knowledge of the sun, there is no means of determining with certainty when the spot cycle passed or will pass the maximum.

M. Tacchini, the Director of the Observatory at Rome, whose views have great weight in the scientific world, holds a different theory. He comes to the conclusion that the solar activity has increased since 1882. He reaches this result by comparing his data collected in 1883 with those

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of the preceding year. Although the relative difference in the number of spots was very small, the number of groups in 1883 was much greater, and the extension of the spots was truly extraordinary, being double that of 1882. This was especially the case in the last quarter of 1883; his more recent observations show that the great activity has continued during January and February of the present year. Therefore, M. Tachini asserts that the maximum of spots has not yet been reached.

When skilled observers differ widely, it is safe to conclude that very little is known about the sun. The existence of the sunspot period may be considered as established; but its exact extent and its cause are as yet unknown, and so is its connection with terrestrial phenomena. Auroras and magnetic disturbances are subject to a period nearly corresponding to that of sun spots, and seem to be bound with them by some inexplicable tie, for they are most frequent when sun spots are most numerous. Whether the solar activity is the cause of the earthquakes, volcanic eruptions, cyclones, tornadoes, and the disturbances that follow in their train is a problem yet unsolved. The sun hides his secrets from mortal ken; we do not even know his exact distance or diameter, nor can we expect in the present attainments of science to find out the cause of the spots with which the sun's fair face has been pitted and marred for several years. Observation is the only key to reveal the mystery. This great power is in full and continuous action.

Many astronomers devote their lives to the study of the sun's face and his surroundings. Not a day escapes, when the sun shows his smiling face, that the smallest mote on his surface is not carefully noted, not a spot escapes the eager eye of unwearied observers. Some day when least expected the reward of the persevering workers will be won. The duty and privilege of the present generation, and of generations to come, are to labor and to wait. Meantime, if sunspots are the cause of the recent frightful agitations of the earth's crust and her atmospheric commotions, it is devoutly to be hoped that the period will speedily reach its maximum—if that event has not already occurred—and that the great luminary will subside into quiescence.

California on the Patent Laws.

The influential citizens of California hold no uncertain opinions concerning the patent laws. Here is the memorial of the Manufacturers' Association, lately presented to the Senate by Senator Farley, read, and referred to Committee on Patents:

To our honorable Senators and Representatives from California in the Congress of the United States:

The Manufacturers' Association of California respectfully address you this memorial in relation to the present situation regarding patents for inventions, and earnestly invoke your active opposition to such bills as have been or hereafter may be introduced into either branch of the national Congress hostile to the progress of science and the useful arts by limiting the just protection to their respective discoveries and appliances.

It is with surprise and fear that we have recently learned of bills greatly impairing if not practically destroying the rights heretofore conferred upon inventors having been favorably considered by the House of Representatives, and we view with anxiety the action of the honorable Senate upon them, and with alarm the consequences which may follow their enactment.

We consider the proposed changes radical and unjust, and liable to seriously injure many and great existing interests, and prevent completion of numerous prospective enterprises by withdrawal of capital and confidence, and raising perilous obstacles to our country's inventive, industrial, and manufacturing progress.

We therefore earnestly and most respectfully protest against the proposed changes and all similar provisions which abridge the usefulness of the Patent Office Department or impair the protection heretofore afforded.

In presenting this request and protest we beg to remind you of some great facts of history which are a part of the common knowledge of the world, namely:

That the general advance of each civilized nation in knowledge and intelligence, in enjoyment of increased comforts and luxuries, and accumulation of wealth has been greatest where inventors are best protected, and that this advance is chiefly due to their discoveries and productions.

That the patent laws do not nor have they ever given the inventor anything beyond an exclusive right for limited time to use or sell that which he had himself created; for this reason the country has lost nothing nor can it lose anything by continuing the patent laws, as wisely provided for in the Constitution of the United States, in all their force and integrity.

That the great inventions and useful discoveries made by inventors in the United States have constituted an advance highway on which our country marches, a proud leader of the nations of the world in all that makes a people intelligent, comfortable, rich, happy, and independent.

That under the incentive and protection afforded to inventors by our patent laws, inventions and improvements have multiplied rapidly, furnishing easier and cheaper methods for agriculture, manufacturing, mining, transportation, and travel.

That the hours of daily labor have been reduced, while the means of livelihood, with enlarged comfort in our homes, have been greatly increased through the changes these inventions have wrought.

The benefits derived by the country from inventive genius and mechanic skill are so immeasurably greater than inventors have gained from the people that comparison ceases.

Referring to these general truths, we send you this memorial protesting against the threatened action inimical to the patent laws, and earnestly soliciting your hearty efforts toward continuing the wise policy which has added so much toward the expansion, prosperity, strength, and glory of our nation, and respectfully express our desire that you will exercise your influence to preserve the body and intent of our patent system, and that all changes be confined to details for correction of abuses and to make it more effective. Respectfully yours,

The Manufacturers' Association of California—A. S. Hallidie, President, Irving M. Scott, Vice-President, N. W. Spaulding, Treasurer, Geo. C. Hickox, Secretary, W. T. Garratt, Arpad Haraszthy, Isaac Hecht, Alanson H. Phelps, A. L. Tubbs, Wm. Harney, S. P. Taylor, David Kerr, Directors.

How Western People Regard the Patent Laws.

It was alleged by the supporters of the hostile patent bills in Congress that a general feeling existed in the Western States adverse to the patent laws, on account of which said laws ought to be repealed or radically changed to meet the popular desires. The allegation was founded in error. The great mass of Western people know that their wealth and prosperity is rapidly augmented by the introduction of new industries, and they are heartily in favor of the patent laws because they exercise such a powerful influence in providing important and profitable manufactures.

As an example of the real sentiment of the people of such States as Illinois, we give an extract of a petition lately presented in the Senate by Senator Logan, which he said had so many signatures that it made a great roll *eighty feet long.*

To the Senate and House of Representatives in Congress assembled:

The undersigned, inventors, manufacturers, and citizens of Chicago and vicinity, respectfully petition our honorable Senators and Representatives to oppose by all legitimate means the pending legislation in Congress hostile to the progress of American invention.

This petition is circulated in accordance with the following resolutions, unanimously adopted at a meeting of the citizens of Chicago and vicinity, held in this city March 24, 1884.

The resolutions referred to are as follows:

We, as the representative inventors and manufacturers of Chicago, having in view the object and scope of our patent law as now embodied in the statutes of this country and construed by the decisions of the courts, and believing all proposed legislation upon the subject of letters patent now before Congress to be vicious in its end and purpose, and destructive to the rights of all inventors or manufacturers under letters patent; and having in view especially section 2 of an act recently passed in the House of Representatives under suspension of the rules and referred to the Committee on Patents of the Senate, and the same having been reported back to the Senate unanimously that it pass, as follows:

Section 2 of the act: "That when in any case the use complained of was an article or device made by the defendant, or his agent, or employe, for his own use and benefit, and not in the manufacture of an article for sale, the measure of recovery shall be a license fee. If in any such case a license fee shall not have been established under the patent or patents sued on, then in any action at law the jury, and in any action in equity the court, shall ascertain what, under all the circumstances of the case, would be a reasonable license fee: *Provided, however,* That this section shall not apply to machinery held for sale or used for manufacturing purposes." Now, therefore,

Be it resolved, That under the emergency existing for immediate action, we hereby express our condemnation and disapproval of the above act, principally for the reasons that it destroys all vested rights of inventors and owners of patents in their property, or of using the same in any instance for their own protection, and is, in fact, a license and an invitation to all pirates and violators of patent property to appropriate the inventions of others, leaving to the inventors and owners of patents only the bare possibility of collecting an uncertain sum to be determined by the uncertainties of a jury or judge at the termination of a necessarily tedious and expensive litigation; and

Be it further resolved, For the above and other cogent reasons, that there be expressed by petition that the above act, and all other acts now pending of an analogous character, are destructive to the rights of inventors and detrimental in the highest degree to constitutional and guaranteed rights of inventors in the progress of science and the useful arts; also

Be it resolved, That a copy of these resolutions be forwarded immediately to the Representatives and Senators, to be acted upon at once in the spirit of these resolutions; and that petitions be at once circulated among the inventors and manufacturers and all citizens, that they may express their protest against such unjust and class legislation; and that no further Congressional action be taken upon the above act until the will of the people is thus expressed by petition.

Be it resolved, That we have an entire confidence in the high honor, justice, and ability of our Representatives and Senators, and believe that the above designated and all analogous legislative action has been sprung upon them by designing men, having in view the supposed grievances of the few, without regard to or due consideration of the great interests and principles involved in the issue.

The Pulley Side of Belts.

There are some questions in practical mechanics that never appear to receive a final and authoritative solution under whatever tests. To this class belongs the question: Which side of a leather belt shall run on the pulley face? In some establishments both ways are practiced, and it would seem that under these circumstances, so nearly uniform, the matter might be at last decided. But the foreman or superintendent who prefers the flesh side to the pulley face holds that his belts last longer than those run by the other foreman in another part of the establishment, who "turns his belts inside out." Of course prejudice has much to do in these cases, and probably prevents a fair conclusion.

A writer in a recent number of the *Jour. of Railway Appliances* says: "I advocate running the flesh side to the pulley, for the following reasons: Leather is fibrous, and curiously constructed, as revealed under a microscope, in the form of a triangle, the tender part, or grain, representing the top part of the triangle, being very fine and delicate, whereas the flesh part, or bottom of the triangle, has a coarser and thicker fiber, and if it is properly skived will be just as smooth as the grain, although a great deal tougher, and will, therefore, stand more wear and friction. If you will notice belts that have run grain to the pulley for any length of time, you will find the grain cracked, and you wonder why. It is because you have subjected the tenderest part of the hide to the hardest usage; the friction has burned the grain, the burning brittled and hardened it; you can never restore it. If you let the flesh part do the work, the grain side being elastic, it will bind the coarser fibrous parts and keep them together."

The principal proprietor of one of the oldest and most extensive manufactories of leather belting in the country recently declared himself as positively and unequivocally in favor of running the flesh side to the pulley, as the result of more than thirty years' observation, and he offered, among other reasons, the quaint one that the belt run thus was in the natural position of the hide. *Per contra*, the superintendent of a large establishment, where heavy machine tools are built, runs all his belts grain side to the pulley faces, claiming a much longer life to the belts and a closer contact between belt and pulley face. In his case, however, all the pulleys are of turned and finished iron.

And it is possible that all these disagreements on this question may arise from the differences in the materials of the pulley faces.

Wooden faced pulleys are coming into use again, particularly for pulleys above twenty-four inches diameter, and leather faced pulleys are very common. It is undeniable that there is a difference in the holding force of these differing faces, as there is in their materials.

The Safest Part of a Car.

A party of merchant travelers in a passenger coach were talking over their traveling experience and the danger of accidents, and finally the question arose as to the safest part of the car. Failing to settle the question among themselves, they called upon the conductor, and one of them said to him: "Conductor, we have been discussing the matter of the safest part of the car, and want to know your opinion." "Want to know the safest, eh?" replied the conductor. "Yes, that's it." "Well," replied the conductor, borrowing a chew of tobacco, and looking disappointed because he didn't get a cigar, "I've been on the road for 15 years, and I have been turned over embankments, busted up in tunnels, dumped off bridges, telescoped in collisions, blown off the track by cyclones, run into open switches, and had other pleasant incidental divertisements of kindred nature, and I should say, gentlemen, the safest part of the car was that part which happened to be in the shop for repairs at the time of the accident."

An Unexplored Table Land.

According to Mr. Im Thurn, whose travels in British Guiana have recently been published, there is in the far west of that country, or over the Brazilian boundary, where the savanna itself rises 5,000 feet above the sea, a flat table land, the edges of which are more or less perpendicular cliffs 2,000 feet high. No traveler has ever been round it, so that it may be accessible from the other side, and there is a way, as yet untried, which Mr. Im Thurn believes may prove practicable. The summit of this plateau of Roraima seems to be forest covered, and enough is known of the fauna and flora of the district to make it certain that a naturalist would find himself well rewarded for the ascent. There are traditions of strange isolated tribes that live in this inaccessible region.

Gratifying Admission.

A gentleman writing from London respecting patent matters, states that he has read the SCIENTIFIC AMERICAN for the last twenty years, and that he hails with delight the time when each paper arrives. "I may," he adds, "state that the success of my life has been mainly due to the hints, ideas, and suggestions that I have gathered from the columns of the SCIENTIFC AMERICAN."

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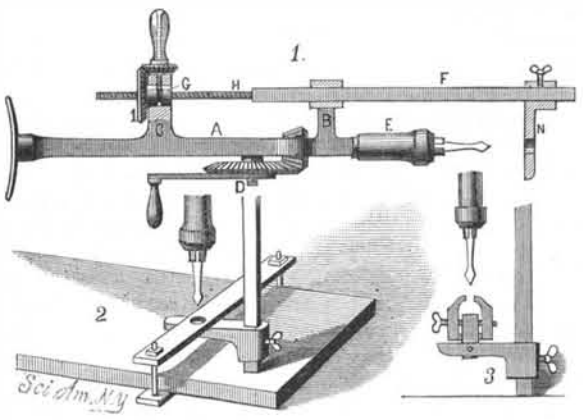
IMPROVED BREAST DRILL.

The drill stock, A, is provided with arms, C B, on the side opposite the crank gear, D, which drives the spindle of the chuck. A strong bar, F, slides in one arm, and its upper end, which is screw threaded, fits in a feed nut, G, in the other arm. On one end of the nut is a toothed wheel that gears with a beveled pinion attached to a thumb bit fitted on a stud projecting from the end of the bracket; by turning the thumb bit the bar can be drawn along the drill chuck, E. The lower end of the bar carries a bracket, N, that serves for a work table, the work being placed on it and forced against the drill by the feed nut, which is turned by the left hand of the operator, who turns the crank gear with the right hand.

When the piece of work is large and heavy, the drill may



HARDISTY'S IMPROVED BREAST DRILL.

be clamped to it by bars, as clearly shown in Fig. 2, or a vise may be secured to the bracket, N, as in Fig. 3, for holding the work by that means. This bracket is fitted to the bar with a binding screw so as to be shifted according to the size of the piece to be drilled. The bar is fitted parallel to the stock, so that the bore will be true when the work is placed squarely on the face of the bracket.

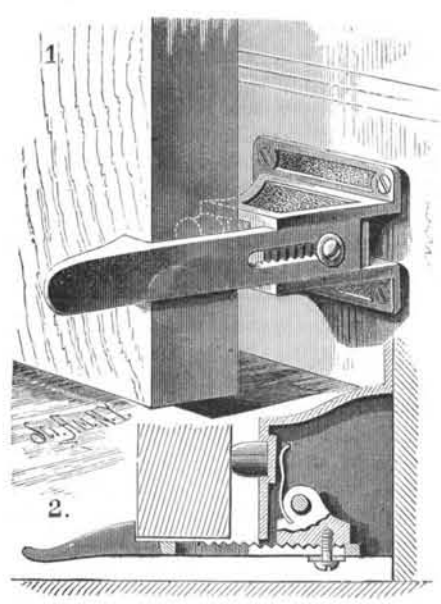
This invention has been patented by Mr. J. F. Hardisty, of St. Joseph, Mo.

New Bone Bleaching Process.

Various chemicals have been used for the purpose of bleaching bones, such as sulphurous acid, chloride of lime, and latterly peroxide of hydrogen; but according to experiments made at the Bavarian Museum of Arts, a very simple and effective method has been discovered, which is said to impart to bones thus treated almost the same appearance as ivory. After digesting the bones with ether or benzine, to remove the fat, they are thoroughly dried and immersed in a solution of phosphorous acid in water containing 1 per cent of phosphoric anhydride. After a few hours they are removed from the solution, washed in water, and dried, when they will appear as indicated above.

NOVEL DOOR CHECK.

The door catch herewith shown automatically engages with the door to hold it open, and can be readily released by a slight pressure with the foot. An ornamental box or case is secured at its back to the base board of the room in such a position that the device will come within range of either the bottom or upright edge of the door. A hook catch, having its rear portion serrated so as to engage with a carrier similarly constructed—shown in the sectional



RALL'S DOOR CHECK.

drawing, Fig. 2—projects from the casing. The catch and carrier are held in engagement by a screw passing through a slot, in the shank of the catch, to provide for the adjustment of the catch to suit doors of different thicknesses. A spring keeps the catch in contact with the door. Projecting from the front of the case is a stop made of some elastic substance which prevents the knob of the door from striking the wall.

This invention has been patented by Messrs. L., G. and E. Rall, and additional particulars may be obtained from M. Lehmann and Rall Bros., of Glasgow, Mo.

Properties of Brass.

The most important properties of brass compared with copper are the following: The color of brass is much brighter, and more approaching to that of gold; it is more fusible than copper, less subject to rust and to be acted upon by the vast variety of substances which corrode copper with so much ease; and it is equally malleable when cold, and more extensible than either copper or iron, and hence is well fitted for fine wire. Brass, however, is only malleable when cold. Hammering is found to give a magnetic quality to brass, and this circumstance makes it necessary to employ unhammered brass for compass boxes and similar apparatus.

The expansion of brass has been very accurately determined, as this metal is most commonly used for mathematical and astronomical instruments, where the utmost precision is required. Mr. Smeaton found that 12 inches in length of cast brass, at 32°, expanded by 180° of heat (or the interval from freezing to boiling water) 0·0225 part of an inch.

Brass wire under the same circumstances expanded 232 parts; an alloy of 16 of brass with 1 of tin expanded 229 parts. The expansion of hammered copper is only 204 such parts, but that of zinc is 253, so that brass holds a middle place in this respect between its two component metals.

Most of the zinc readily burns off from brass when kept melted in a strong heat with free access of air. When the heat is equal to that of melted copper, the zinc takes fire and slowly burns away. At last, little else but copper remains, but still united with a small portion of zinc, which no further continuance of the fire will entirely separate.

Some kinds of very fine brass are said not to be made by cementation, but by a more speedy and direct union of copper and zinc, care being taken to prevent the access of air to the materials while in fusion. Very fine brass may also be made by mixing together the oxides of copper and zinc and reducing them with a carbonaceous flux. Sage gives the following experiment to this purpose: Mix together 50 grains of the oxide of copper, remaining after the distillation of verdigris (which is very pure), with 100 grains of lapis calaminaris, 400 grains of black flux, and 30 grains of charcoal powder; melt the mixture in a crucible till the blue flame is seen no longer round the lid of the crucible, and when cold a fine button of brass is found beneath the scoria, weighing a sixth more than the copper alone, obtainable from its oxide in the same way, but without the calamine. This brass has a very fine color, like gold.

On this experiment M. Sage observes that there appears to be a point of mutual saturation between the two metals, which is when the copper retains one-sixth of zinc, and this portion it will retain however long it is heated, provided the surface of the melted metal be covered to protect the zinc from the action of the air; but if the brass contains a greater proportion of zinc, precisely this excess will escape, even in covered vessels, and will burn when it comes out to the air.

The same chemist also observes that the color is the finest at the above proportion. These experiments seem to require further confirmation, but we may reckon that to be the most perfect brass which is composed of about 14·28 per cent of zinc and 85·72 of copper, and which is not liable to any alteration in its constituent parts by successive or long continued fusions, provided the access of air be prevented.

Analysis shows a vast variety in the proportions of the different species of brass used in commerce. In general the extremes of the highest and lowest proportions of zinc are from 12 to 25 per cent of the brass. Even with so much as 25 per cent of zinc, brass, if well manufactured, is perfectly malleable, though zinc itself scarcely yields to the hammer. M. Dize analyzed a specimen of remarkably fine brass made at Geneva, for the purpose of escapement wheels and the nicer parts of watch making, the perfect bars of which bear a very high price. This metal unites great beauty of color to a very superior degree of ductility. It was found to consist of 75 of copper with 25 of zinc, and probably, too, the copper was Swedish, or some of the finer sorts. The common brass of Paris seems to contain about 13 per cent of zinc, the English probably more.

Brass is applicable to an infinite variety of purposes, is easily wrought by casting and hammering, and by the lathe, its wire is eminently useful, and it takes a high and very beautiful polish. The appearance of brass is given to other metals, by washing them with a yellow lacquer or varnish, a substitution often very much to the detriment of the manufactured article.—*Glassware Reporter.*

A Preventive of Stopped Ascension Pipes.

The manager of the gas works at Deventer, Holland, has adopted, for preventing stoppages in his ascension pipes, an exceedingly simple arrangement, which is described in the *Organe Industriel de l'Eclairage.* The system consists in the insertion in the mouthpiece end of the retort, immediately after charging, of a sheet of iron fitting the retort as closely as possible. This piece of sheet iron has in the middle a hole equal in area to the ascension pipe. The tarry vapors, heavy oils, and carbon dust are for the greater part arrested by this plate, and are thereby prevented from rising a few feet higher, and condensing on the interior surface of the ascension pipe. The office of the plate is simply to arrest as far as possible the matters that in the ordinary way settle at the lower end of the ascension pipe.

FOLDING STEP LADDER.

The invention shown in the annexed cut was recently patented by Mr. George A. Sommer, of 265 Greene Avenue, Brooklyn, N. Y. The side boards, steps, landing, and standard are of the usual form, except that the side bars of the latter are pivoted to the side boards near the landing. To the upper ends of these bars are pivoted the ends of side rails, whose lower ends are pivoted to links joined to the side boards near their lower ends. When the standard is closed against

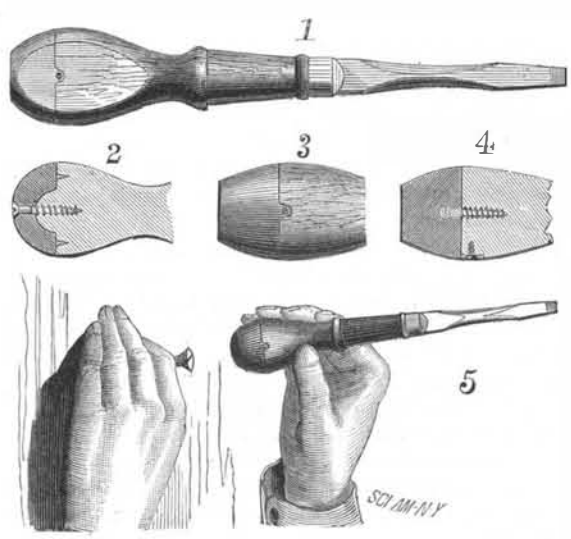
SOMMER'S FOLDING STEP LADDER.

the back of the ladder, the rails are folded down along the side boards; when the lower part of the standard is moved away from the ladder, the rails are extended along the front so as to assist a person to ascend and descend the ladder. The rear edges of the side boards are provided with notched braces that prevent the standard from being swung out too far and that hold the ladder in open position for use. The braces come into position automatically, requiring no attention on the part of the one using the ladder.

AN IMPROVED TOOL HANDLE.

The annexed engravings show a useful improvement that can be applied to the handles of many kinds of tools, and for which letters patent were recently granted to Mr. John A. King, of 2,015 Chestnut Street, St. Louis, Mo. The wooden portion of the handle is provided with a metal cap secured in position in any suitable manner. In the construction shown in Fig. 2, the cap has a recess for receiving a projection on the wooden portion of the handle; it is held on by a screw, and is steadied by pins entering the wood. In Figs. 3 and 4 the screw is made a part of the cap, and turning is prevented by a thin lug on the cap entering a recess in the wood, and being held in place by a screw. The handle may be made with flattened sides as shown in Fig. 1, or with a globular end as in Fig. 5, the form being governed by the work to be done with the tool.

This plan not only increases the durability of the tool by strengthening that part which is subjected to rough usage, but permits the tool to be used for purposes for which it would not otherwise be adapted. In ordinary work the starting of a screw takes time; the change from the screw driver to the hammer and back again having to be gone through with before the turning is begun. In this case all the time consumed is in the turning of the tool end for end, as indicated in Fig. 5. The metal cap perfectly protects the wooden handle.



KING'S IMPROVED TOOL HANDLE.

The various applications of this improvement will be readily perceived by those who have felt the want of such a device.

SALTING WALKS.—The best way, says a correspondent, to apply salt to paths, to destroy weeds, is as follows: Boil the salt in water, 1 pound to 1 gallon, and apply the mixture boiling hot with a watering pot that has a spreading rose; this will keep weeds and worms away for two or three years. Put 1 pound to the square yard the first year; afterward a weaker solution may be applied when required.

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Flexible Photographic Plates.

Photographers, both amateur and professional, have long wanted some thoroughly efficient substitute for glass as a support for dry plate films, and a few attempts have been made to supply the want with more or less of success. The following method has been recently patented in this country on behalf of Messrs. Fickeissen and Becker, of Villingen, Baden. The plates or surfaces can be prepared from paper, cloth, or other suitable fabric or material, but by preference from white paper containing very little size and not much grain. This paper is first extended on a frame or other arrangement, according to the size of the plate or surface which is desired. After it is dry the surface is covered in any convenient manner with a fine varnish or composition, such as copal varnish, for the purpose of rendering the fabric transparent; it is then dried, and after it is quite dry the surface is rendered smooth by the application of powdered pumice stone or other suitable material, or it may be smoothed by suitable machinery.

This process of smoothing may be repeated, if necessary, two or three times until the surface or plate is smooth or transparent. The surface so prepared is then covered on one or both sides with a solution of gelatine, isinglass, or other substance possessing similar properties, and allowed to dry. The surface so prepared may, if desired, be further treated with a preparation of ox gall from which the fatty matter has been extracted by acetate of alumina or similar acting agents, which will precipitate the fat of the gall, the resulting preparation being then passed through a filter, whereby a clear solution will be obtained with which the plate or surface may be covered, so as to secure the safe reception of the emulsion for photographic or other use. Instead of ox gall, any similarly acting substance or material may be used.

The plates or sheets prepared as above may be used with great advantage in reproducing photographs from nature in lines or stipples for calico and other printing, as the stipples or lines can be printed first on the material before it is made transparent. Any photographic design or drawing can be put on the transparent surface in the usual way, and by using the film as a negative or positive in photographing from nature or from a drawing, half tones will be reproduced in lines and stipples available for any kind of printing. As these plates or sheets are waterproof, they can also be used as surfaces upon which can be printed or produced all kinds of ornamental and useful work.

Porpoise Fishing on the Atlantic Coast.

The *Public Ledger* states the result of the first effort this season to entrap porpoises off the coast of North Carolina. It resulted in the capture of 75 fat porpoises, which were taken to Philadelphia to be "*tried out.*" The estimated weight of the catch is 45,000 pounds, from which Capt. John A. Cook, superintendent of the company, roughly calculates will be procured 1,000 gallons of oil, 3,750 pounds of leather, and 15 tons of phosphate. The hide will make a leather pronounced equal to the best French calf skin, and the oil is said to be superior to sperm oil. Leather from this source has been made in small quantities for some years in England and Germany; it is fine and strong, and makes the best shoe laces.

The fishing, it is said, will be continued, but as the weather is getting warm it is probable that the next catch will be "tried out" at an establishment on the coast. It is intended to fish in Chesapeake Bay, and about June 1 operations will commence at Cape May, and continue during the summer. The net used is something like what is known as a "fyke" net, and is, with the wings, a mile long. The bag into which the fish are inveigled is 60 feet wide, 24 feet deep, and 120 feet long. The 75 fish were caught in two hauls, the first bringing in 39, both hauls being made in one day.

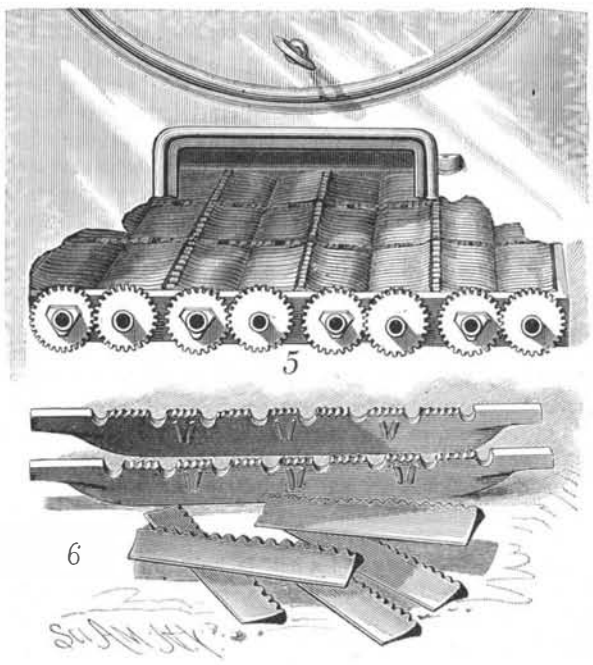
Water from Eucalyptus Roots.

In many parts of Australia, where water is scarce, the natives formerly procured it from the roots of the eucalyptus and a few other trees. The tree most preferred throws out numerous lateral roots, which lie at a depth of from six to twelve inches below the surface.

According to a writer in the *Proc. Linn. Soc.* of New South Wales (vol. viii., 1883), the native having ascertained, by means of prodding with a pointed stick or spear, the position of some of the roots, "removes the superincumbent soil with his wooden shovel for twenty or thirty feet, and cutting the root off at each end lifts it out of the trench and cuts it up into lengths of about eighteen inches or two feet, knocks off the bark, and stands the several portions on end in some receptacle to contain the water. . . . As soon as these pieces are placed on end, the water commences to drip, and when the whole of the root or roots are cut up and placed on end, the native, beginning at the first placed, puts the end in his mouth and by a vigorous puff expels the remaining water. . . . The water is beautifully clear, cool, and free from any unpleasant taste or smell."—*J. F. J., Amer. Nat.*

IMPROVED FURNACE GRATE.

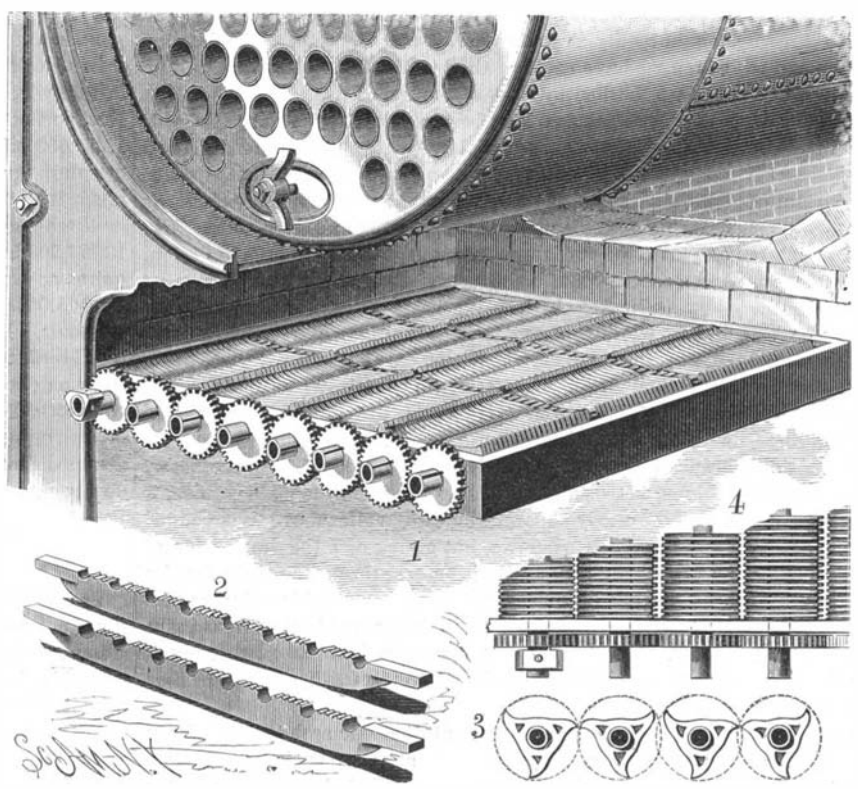
The accompanying illustrations represent a new and effective method of removing the refuse—ashes, clinkers, slate, and all foreign and incombustible matter—from the fire chambers under boilers, forges, furnaces, etc. This invention has been patented by Col. J. A. Price, of Scranton, Pa., and is a direct result of an intimate acquaintance with the problem in all its aspects, and of long continued study of the mechanical details. The grate insures complete combustion by reason of an absolutely clean fire bed, and reduces



PRICE'S IMPROVED FURNACE GRATE.

the waste arising from unconsumed fuel to a minimum, beside saving both time and labor in cleaning.

The grate consists of tubular shafts connected by gearing, and having mounted thereon a series of cutting fire arms or bars which operate in pairs when the grate is constructed as shown in Fig. 5, and together when made as in Fig. 1. The action is positive, and any foreign substance lying upon the grate is cut up and discharged. The cutting arms are slipped upon the tube, which is either ribbed or grooved to meet a corresponding groove or rib in the cutting arm, thus fastening all into a rigid mass capable of making a cut of any length up to ten or twelve feet. Fig. 2 represents cross bars, whose ends rest upon the sides, which serve as carriers. Fig. 6 shows the form of cross bars used when the cutting arms are arranged in pairs; the same figure shows the dividing bars, which divide each pair of arms and which are supported by lugs upon the sides of the cross bars. Fig. 3 is a vertical cross section, and Fig. 4 a plan view of the grate. The shoulder on the cutting arm constitutes the



PRICE'S IMPROVED FURNACE GRATE.

spacing of the bars, which may be larger for coarse and finer for small fuel, and so on down to culm, or coal waste.

The tubular shafts are open at each end, and the natural passage of the cold air from the outside to the high temperature of the inside, into which they discharge under the burning surface, serves to preserve them from the action of the fire; they are further protected by the cutting arms slipped upon them. These tubes can be converted into water bars by the use of socket joints without interfering with the action of the grate in the least. A simple lever turns one pair or all, or an adjustable clutch can be arranged to connect with some moving part of the engine, thereby doing away with the labor of the engineer or fireman. The fire can be effectively cleaned without opening the door; steam will not run down during the operation, and the boilers will not suffer in consequence of the expansion and contraction caused by the frequent opening of the doors. This fact will be appreciated by locomotive engineers. A light or thin fire bed, free from clinker bridging, can always be maintained. Culm, coal waste, or dust can be taken direct from the deposit and used, no preparation being needed.

What the Elevator Has Done.

The marvelous advance in the construction of business and residence dwellings in New York and other large capitals of the world is clearly due to the use of the elevator. The substitution of steam for human strength in lifting people from the ground to the upper floors of structures has radically changed not only the appearance of the streets, but our methods of living and doing business. Fifteen years ago these great business and apartment edifices were unknown. The possibilities of the elevator were only then beginning to be understood. But what a change has occurred in our leading business streets! Without the elevator we would have been deprived of every striking structure in New York. There would have been no Equitable, Mutual Life, Mills, Western Union, Temple Court, Morse, Field, Boreel, or Tribune building, and then there are literally hundreds of apartment houses which would not have been erected had it not been for this very simple means of "getting up stairs."

Of course high buildings have their disadvantages. They imperil human life, if not incombustible. They exclude light and air from neighboring houses, and then they are manifestly out of place on narrow streets. But notwithstanding these drawbacks, the building of these great establishments will be continued. The average builder and householder is opposed to them, and cordially seconds the bill now before the Legislature to put a stop to their construction. They are, however, so comfortable, convenient, and profitable that no law can stand, even if enacted, limiting their height. New York is designed to become a city of monster buildings, and no legislation will avail against the inevitable.

The public, however, has a right to demand that these high structures shall be fireproof, and that there shall be ground or courts about them, so that they cannot interfere with neighboring property. The rule should be, at least 40 per cent of vacant space wherever a high building is erected. The limit now demanded by law is too small. Life and property should be protected, but beyond that there should be no interference with capitalists who wish to invest in this latest outcome of business and domestic architecture.—*Real Estate Record.*

How to Prevent an Epidemic of Small Pox.

The metropolis is again threatened with an epidemic of small pox. The disease, which broke out some weeks ago in the northeastern district, is now prevalent in Hackney and one or two adjoining parishes, and the number of cases under treatment in the Asylum Board Hospitals has risen from 150 in the middle of March to 273 on April 7. The frequent occurrence of outbreaks of small pox in London, and the great expense entailed by treating and isolating the cases in hospitals, make us ask the question: Can an epidemic of small pox be prevented? It is a well known fact that a very large proportion (75 per cent being the average) of those nowadays attacked with small pox have been vaccinated in infancy, but that after a time the protection against small pox afforded by vaccination seems to die out.

We have before us statistics of 17,756 cases of vaccinated small pox cases of all ages, treated in the London hospitals from 1871 to 1881. Of these 15,903, or 90 per cent, were over 10 years of age, while only 10 per cent were under 10 years. This shows in a sufficiently definite manner that, of the vaccinated population, children under 10 years are very little liable to small pox, and that the incidence of small pox is in those who have passed the age of childhood, and are entering on or have reached adult life. To afford protection against small pox to adults in the same measure as we now do to children by vaccination in infancy, is clearly the only effective means (apart from isolation in hospital or at home) of preventing epidemics of small pox; and, to effect this, a second vaccination should be performed soon before or at the age of puberty. We have frequently instanced the experience of small pox hospitals, where the staff there employed are revaccinated, to show the complete immunity from small pox enjoyed after revaccination by those engaged in nursing the sick. If the public would protect itself against small pox in the same way that officials of small pox hospitals do, this loathsome and dangerous disease would never assume the proportions we have been accustomed to see during the past fifteen years. To prevent an epidemic of small pox, we unhesitatingly say that the only effective measure is revaccination.—*British Medical Journal.*

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NEW BUILDINGS OF PROMINENCE IN NEW YORK CITY.

[SEE FRONTISPIECE.]

If, as it has been said, the progress of a nation is written in its architecture, most assuredly a glance around our own city will show a degree of progress within the last five years unrivaled by almost any city in the world; a view then of some of its structures will not be uninteresting to our readers. It will also reveal several facts in regard to the increasing value of real estate, and a corresponding change in the methods of erection.

To the outsider, who should visit our city to-day after an absence of five years, the tremendous size and height of many recent buildings would be a surprise, and a ride on the elevated railroad from the Battery to 159th Street, on the west side, would convince him of the truth of our first statement in regard to the progress and, we may say also, the prosperity of the city.

In the vicinity of Central Park, and most beautifully situated, are two buildings that from their excessive size and height force themselves upon the view from almost any point north of 59th Street. The style of the two buildings is in marked contrast, and forms an interesting study of that comparatively new class of building with us, the apartment flats.

The Dakota flats, 8th Avenue between 72d and 73d Streets, from the hand of Mr. Hardenberg, is a large nine story building, in buff brick, with quoins, jambs, bays, and cornices in Ohio stone, the details being in the style of the Renaissance, and in plan consisting of a large central court with its surrounding buildings, the rooms being on a magnificent scale, and most sumptuously furnished.

Each elevation shows three distinct features, the central one on 8th Avenue covered by a hipped roof, and that on 72d Street by a gable, while the two flanking portions are also in each case covered by gables; and each in turn is connected by an arched balcony, most happily designed. Above the second story is an ornamental band with moulded belt course above, whose beauty, however, it must be said, is marred by being continually broken into by the arches of the windows. Above the sixth story is the cornice, in design of the Chateau de Blois order, while above is the steep roof broken by numerous dormers and bay turrets. The entrance is on 72d Street, and although it runs through the two lower stories, and is profusely ornamented, from a critical point of view its two arches interfere with each other, and detract in some degree from the dignity of a feature which so massive a building seems to demand.

It is an axiom as old as the Greeks, that the true test of a building is to strip it of its ornamentation, and mark the result of its mass. In this case most certainly the result would not be disappointing, for the several parts are simple in mass, possessed of a quiet dignity, and the disposition of the roofs well composed. We cannot help feeling, however, that the color of the material detracts from this dignity in no small degree.

This feeling is strengthened, too, as we walk down 8th Avenue, and approach the large group of buildings known as the Navarro flats, between 58th and 59th Streets and 7th Avenue, composed of red brick and trimmed with brown stone. The buildings are eight in number, are known as the Madrid, Cordova, Grenada, Valencia, Lisbon, Barcelona, Saragossa, and Tolosa, occupy a plot 201 by 425 feet, and are the work of Messrs. Hubert & Piersson. As will be surmised from their names, the buildings are in the Moorish style of architecture, and are by far the most important of their class in the city.

In plan they consist also of large central courts, which in this case are to be turned into gardens for the exclusive use of the occupants. By a duplex system of floors some of the flats are in two stories; all the rooms are open to the exterior light and air, are large and numerous, and furnished with every possible luxury. A most pleasing and effective feature is the arched balconies on the third, fifth, and seventh stories, which, although they connect the buildings, yet leave them open on the side to light and air, besides giving them a spacious covered balcony, which we venture to predict will be a most welcome retreat in summer. From an exterior view, the corners are flanked by circular oriels, running from the pavement to the roof, a height of nine stories.

The first and second story in each building is in rock face stone, with thin alternate tooled bands of the same material, a treatment that is most beautiful in effect; but it is extremely doubtful if the change in the color of the stone in each building does not detract from the general appearance. Above the second story to the cornice is brick work, relieved by diaper work, and the whole surmounted by a low roof, very much broken up, and the most unsatisfactory part of the whole work. The glory of the Dakota is most certainly the faulty feature in the Navarro.

The effect of the buildings will be best seen by standing at as great a distance as possible, and noting the very picturesque sky lines, which are emphasized by the chimneys and oriels with good effect.

The two central buildings on Fifty-eighth and Fifty-ninth Streets, when completed, will form by far the finest group on either street, being most simple in form and detail, consisting of two simple and graceful columnated entrances, four flanking bays in iron work of Moorish design, and the central portions broken at regular intervals by window openings, giving an effect most quiet and restful. These buildings form a most interesting group, and their location cannot be excelled in the city of New York.

In the center of the activity of Twenty-third Street is the little building known as the Eden Musee, in the style of the French Renaissance, that has attracted considerable attention during its erection. It is from the pencil of Mr. Fernbach, who, however, did not live to see it completed, and it is one of the very few buildings of its style in New York, although common to almost every avenue in Paris. It is but two stories with attic in the steep roof, and consists of five sections, divided by pilasters on the first story, small caryatides on the second story, and is rather overloaded with detail and ornamentation. Over the central bay is a polished Tennessee marble slab with the name in gilt, and capped by a curved pediment, while the two side sections have three small windows over the entrances and a pediment dormer above. A rather slight bronze grill ornaments the central section on the first story, and it is supposable that the doors are at present temporary only, as they do not in any way harmonize with the building; rather detract from the general appearance by their cheapness.

Another jaunt toward the Battery brings us to the busiest portion of the city, where we find a magnificent structure on Nassau Street now nearly completed, and the property of the Mutual Life Insurance Co. Mr. Clinton has here given New York a notable and worthy building, but has worked under the embarrassing condition of narrow and cramped streets, so that much of its beauty is lost to the eye. The building takes in the whole square upon which the old post office stood, and the facade on Nassau Street is divided into three distinct bays, the central one breaking back a couple of feet, and occupied in part by the entrance porch. The first story and a half is built up with granite piers slightly rusticated, and gives an appearance of strength and solidity to the whole structure. Above, a light sandstone is used, and the second order is formed by square pilasters of small height in proportion to their width, which support a cornice breaking around the whole building. Above this cornice starts the happiest feature of the building, consisting of simple flat pilasters with carved capitals and arched heads, inclosing four stories in height.

Still above the main cornice is another story, with ornamented balustrade above, but entirely lost to view, owing to the tremendous height and the narrowness of the street. Perhaps the finest feature is the porch, running two stories in height, and consisting on the first story of square pilasters covered with Renaissance carving, and flanked by a column in alternate courses of polished and fluted granite. Above are still other square shafts, with two polished granite columns. It is perhaps the most magnificent porch in the city. Mr. Clinton has been criticised as building an architectural folly, because of the relation of the new building to its surroundings. But this is evidently unfair, since, were any such rule followed out, our architecture would become a mere adaptation of a building to its surrounding buildings, be they high or low, good, bad, or indifferent, instead of standing on its own merit as an architectural work; and we may thank the architect in the present instance for ignoring just such absurd criticism, and placing on his site a building that stands head and shoulders above its neighbors in reality as well as architectural worth. The drawing which we have made of the building is taken from a lithograph published by Root & Tinker, of this city.

Battery Park has long been regarded as a most desirable location for a building of large proportions, and Mr. Post has recently placed upon one of its most important sites the building known as the Produce Exchange, a large building covering a whole square, and in brick and terra cotta. Unlike many of our large structures it is very simple in design, and a repetition of a single well designed feature. The first story is broken by massive brick piers, inclosing an iron framed window of ornamented mullions and transoms, and supporting a heavy frieze and cornice, upon which starts the second order of pilasters, of brick, with noble round arches of brick and terra cotta, the spandrels being filled with ornamented terra cotta panels, from which spring the heads of different animals in strong relief. Above these, inclosed between the frieze necking and the main cornice, is a row of nearly square windows, while above is an added story of arched windows, but giving one the impression of an afterthought or an addition. In the center of the facades are the triple entrances, with polished marble columns projecting from the face of the building, and backed by massive arches. The huge tower is unseen from Broadway, but it forms a conspicuous landmark to the south, and can be seen far away at sea.

As an example of the recent domestic architecture of our city, perhaps no buildings have attracted such general attention as the Vanderbilt mansions on Fifth Avenue. By far the finest of them is the studied work of Mr. Hunt, on the corner of 52d Street, and reminding one strongly of the old French chateaux in the departments of Indre-et-Loire. Could it have been surrounded by trees, away from the whirl of Fifth Avenue, and its area filled with water, after the fashion of a moat, we should verily have had a small Chambord, a Chenonceaux, or an Azay-le-Rideau. The arched entrance is broad, highly ornamented, and surrounded by a balcony whose sides are enriched by most delicate carving. Above is a beautifully proportioned triple window, over which runs the cornice with its hipped roof and dormer. In the angle of the entrance is quartered a small circular stairway, with profuse exterior ornamentation, and capped by a veritable "extinguisher top" roof.

Best of all is the extreme simplicity of the main double windows, repeated in the three stories of the main building, and ending in a dormer of exquisite design. On the side are three bays, one a hanging oriel window, supported upon an enriched and moulded corbel, while the bay itself is broken by a triple window with carved pilasters and delicate carved panels above and below. Above the bays are two more large dormers of somewhat similar design as on the front. A noticeable feature in Mr. Hunt's design is the large amount of honest, unbroken wall surface, which gives the building breadth and character, notwithstanding the unusual amount of enrichment, and this fact is the more marked because of the almost universal mania of architects to break up every surface by unmeaning panels or windows.

The buildings of which we have thus made slight mention are but a half dozen of the hundreds that are springing up all over New York, that are beautifying our streets, and bidding fair to make the city the architectural center of the country.

The Future Consumption of Cotton.

It appears from the statistics of W. John Basilie, who has patiently investigated the subject, that the total production of cotton last year amounted to 9,410,000 bales. The quantity consumed may be thus approximately reckoned: America, 2,238,000 bales; England, 3,666,000 bales; European Continent, 3,120,000 bales. The consumption of cotton by Indian spinners may be left out of consideration. All the cotton produced went into consumption with the exception of a trifling balance of about 386,000 bales, and, as the records of previous years show similar results, the first portion of the theory advanced may be assumed to be correct.

Now let these figures be analyzed so that data may be obtained as to the probable future consumption of cotton. The consumption of cotton in England for cotton goods exported is 2,534,760 bales, and the consumption of cotton goods in Great Britain is 1,131,240 bales, this latter quantity being equal to 12 pounds of cotton per annum for each person. The consumption of cotton goods sent from England to the East Indies averages annually 1,737,000,000 yards, equal to 1¾ pounds of cotton per head; and to China and Japan 443,000,000 yards, or 4 ounces of cotton per head. The consumption of cotton in Europe for cotton goods imported is 620,000 bales, and the cotton consumed on that continent for cotton goods there manufactured is 2,500,000 bales, equal to 6 pounds of cotton per head. The consumption of cotton in the United States for cotton goods exported is 1,403,000 bales, and the cotton consumed for cotton goods manufactured for home use is 835,000 bales, equal to 6 pounds per head. Taking past experience into consideration in conjunction with last year's consumption, it is underestimating future consumption to assume that within the next three years the requirements of the East Indies, China, and Japan will rise to 2¼ pounds of cotton per head, which will give an increase of 2,478,200 bales. It has already been said that the consumption of cotton in Great Britain is 12 pounds per head per annum, and on the Continent 6 pounds per head per annum.

Ignore any increase in the consumption of Great Britain, but allow the European consumption to increase from 6 pounds to 8 pounds per head, which is a moderate computation, seeing how the consumption has grown during the last decade, and in two or three years there will be from Europe alone an increased demand for cotton amounting to 1,250,000 bales. Then allow an increase in the American consumption to bring up its total to 2,613,000 bales, and the result is that within a year or two, or it may at the outside be three years, there will be required by cloth manufacturers 13,127,200 bales of cotton for the year's work, and it requires no stretch of the imagination to see that in five years' time 15,000,000 bales will be required for manufacturing purposes. It is not intended in this article, says *The Textile Record*, to discuss the source of supply, but simply to show an enormous increase in the future in the demand for cotton. All calculations respecting the output are liable to miscarry, but in those above named it may confidently be assumed that they underestimate probable requirements, and do not err on the side of exaggeration.

Sawdust in Plastering.

Two Western inventors have recently obtained patents for the use of sawdust instead of sand in plastering compositions, and this, it is conceived, may be a matter of considerable importance to the owners of sawmills in the principal lumbering towns. One of the patents is for the use of nearly equal parts of plaster of Paris or cement and sawdust, with the ordinary amount of plastering hair and water; the other calls for the use of about 4½ pounds each of slaked lime and sawdust to 1 pound of plaster of Paris, a quarter of a pound of glue, and a sixteenth of a pound of glycerine, with plasterer's hair. Whether or not either of these described plasters would be cheaper than those made in the ordinary way, they would certainly be lighter, and it is believed that they would better adhere to the walls, and not be so liable to chip, scale, and crack. Sifted sawdust has before been used to some extent by experienced workmen for mixing with mortar for plastering external walls, exposed to the alternate action of water and frost, as a preventive of scaling. Certainly the experiment of introducing sawdust in place of sand in mortar is worth trying, for in many places sharp sand suitable for the purpose is difficult to obtain.

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Correspondence.

Chinnook Winds.

A NEW THEORY BASED ON SCIENTIFIC OBSERVATION.

To the Editor of the Scientific American:

I have for two or three years past felt a deep interest in the phenomena so often presented here in Eastern Montana, and termed the Chinnook wind. This is a wind blowing to us from W.N.W. or N. 77° 30′ W., never varying its course. There is nothing in physical or in meteorological science that teaches us that a wind from this direction could be superficially heated by the surrounding temperature or the climatic conditions prevailing in the latitudes from whence it comes; and careful thought long ago convinced me that, even could a warm wind originate in almost the Arctic regions of the far northwest, it absolutely must be robbed of all superficial heat in the passage over two thousand miles of fields of snow and ice encountered before reaching the plains of Eastern Montana. These mental deductions led me to make instrumental observations on the late Chinnook wind, which swept over this region on the 23d and 24th of February last. The wind struck at 2 A.M on the morning of the 23d, accompanied by a light shower of rain. At 10 A.M. on the 23d, the wind appeared to come down from the passing clouds; to test and fully demonstrate the fact, I attached a light streamer to a pole three times its length, and set the flag upon an adjacent elevated crowning *butte*. The dip of the streamer throughout the whole period of the wind, which prevailed for forty-eight hours, was 22° 30′ below the horizon.

On Monday following, when the wind changed to the northward, the streamer stood out parallel with the horizon, inclining a little upward, not unlike a streamer on the topmast of a schooner. I do not think that the streamer was influenced by the topographical features of the land in close proximity. The above experiment appears to show conclusive evidence that the Chinnook winds come from the higher atmosphere, and therefore refutes the old idea that this class of winds are the Pacific trade winds breaking through the mountain passes, and so finding their way to the cattle fields of Eastern Montana. In connection with observations above detailed, I further noticed the peculiar effect produced upon the snow and ice, the former being apparently dissipated and the latter disintegrated, as if the effect was not due to the presence of heat so much as to a chemical reagency. As a further proof I would cite that either by the sun's rays or a warm wind the snow would only be taken from the surface, but I find such is not the case with this wind. Taking the angle before given and observing it strictly on the side hills to leeward (to use a nautical term), and lying below the angle of incidence, 22° 30′, and no marked effect was produced upon the snow and ice, while surfaces exposed to the wind within this angle were entirely freed from snow, and in the case of ice the body was disintegrated to such a degree that it was rotten or brittle, *i.e.*, devoid of molecular affinity.

The great region embraced between the Rocky Mountains and the Dakotas, comprising the Yellowstone Valley, was, on the morning of the 23d of February last, covered with snow from one to two feet deep, and the ice, in the several great rivers, ranged from two to three and a half feet thick. In a little less than forty-eight hours this vast region was shorn of these habiliments, and its tributary rivers were all flowing into the principal valleys below.

The deductions are that the Chinnook is an upper current of air, so to speak, of one of the atmospheric arteries, bearing a regular and defined course, as note the Gulf Stream in the ocean; that this aerial current becomes depressed and reaches the earth, and that the portion of such current that strikes any part of Montana is in all its elemental purity, and only comes in contact with the surface at the point where we observe its influence at work, and has not previously blown over and been in contact with other snow and ice. The wind itself is not noticeable for any element of warmth, but on the contrary it is raw, and a person exposed to it for any length of time experiences a chill feeling.

WILLIAM B. GAW,
Civil Engineer.

Miles City, M. T., April 16, 1884.

Walking, Running, and Jumping in England.

Four miles an hour is the ordinary standard pace for a good, brisk country walk; what shall we say, then, to eight miles in an hour, fair heel and toe? Yet this has been done by W. Perkins, J. Raby, Griffin, and other professors of the art. Perkins, indeed, has walked one mile in 6 minutes and 23 seconds—a rate of progression nearly approaching 9½ miles an hour. On the same occasion he walked two miles in 13 minutes 20 seconds, and three in 20 minutes 47 seconds, both unequaled records. The greatest distance ever walked without taking a rest is 120 miles 1,560 yards, by Peter Crossland, of Sheffield.

The greatest distance ever run in one hour is 11 miles 970 yards, by Deerfoot, at Old Brompton, in 1863—Deerfoot's real name being L. Bennett, Cattaraugus County, New York State. The fastest time in which one mile has ever been run on level ground is 4 min. 16⅛ seconds, by W. Cummings, of Paisley, in 1881, at Preston; but in 1863 W. Lang ran a mile over a course which was partly down hill in 4 minutes 2 seconds. The *swiftest* runner hitherto seen is a man named Hutchens, formerly newsboy at Putney Station. In a Sheffield handicap he has covered 131¼ yards in 12¼ seconds, a performance which shows him many yards better than "even time" at 100 yards, and even time is the unattained ambition of the great army of amateurs. (A hundred yards in "even time" means 100 yards in 10 seconds, or a rate averaging 10 yards per second.) And he has performed the prodigious feat of covering 300 yards in 30 seconds, dead, the most wonderful piece of running on record.

In 1873 R. Buttery, of Sheffield, ran a quarter of a mile in 48¼ seconds, which remains unbeaten to this day. George Hazael has run 50 miles in three seconds less than six hours and a quarter, and he has also performed the prodigious task of covering 600 miles in a 6 days' "go-as-you please," a pedestrian journey in which the competitors may run or walk as they prefer.

As to jumping, amateurs who patronize the sport jump without any artificial aid. The records among the latter are both held by the same athlete, P. Davin, of Carrick-on-Suir, Ireland, who has cleared 6 feet 2¾ inches high, and 23 feet 2 inches wide, both at local athletic gatherings. M. J. Brooks, who in 1876 won the Inter-'Varsity high jump with 6 feet 2½ inches, is said to have cleared an inch more in practice. John Howard, a Bradford professional, more than once cleared a full sized billiard table lengthways—a feat requiring courage as well as ability; and on one occasion, on Chester race course, he jumped the enormous distance of 29 feet 7 inches! He took off from a wedge-shaped block of wood, raised four inches from the ground, and carried a five pound dumb bell in each hand. In pole jumping—prettiest of all athletic pastimes—the great height of 11 feet 4½ inches has been cleared by the present amateur champion, T. Ray, of Ulverstone.

Optical Illusions.

When the eye is deceived and a person misled by things seeming to be what they are not, it is spoken of as an "optical illusion." The familiar expression that "seeing is believing" implies that most people trust to their eyes more than to their other senses. "I have seen it with my own eyes" is looked upon as an indisputable, a convincing argument, although there are a few doubting Thomases who would add the testimony of the sense of feeling to that of sight before admitting that a thing is actually so.

The facts in the case are that any one of our senses may mislead us, and will do so unless we unite caution with experience. As sophists use logic to prove the false true, so the ventriloquist by the exercise of his art deceives the ear, and the sleight of hand performer cheats our eyes. How is this possible?

Certain rays of light coming from a distant body enter the eye, and produce certain sensations upon the retina, which sensations are reported to the brain through the optic nerve.

The brain interprets the signals by the aid of past experience, and we *think* we have seen the distant object. In fact, we have only received a message from it. If the telegraphic operator in Washington strikes his key twice, the New York operator writes down O, but if he strikes it three times the latter writes down S, unless he fails to hear the third tick, or thinks he has heard but two, when he is led into the mistake of writing O where he should write S. The signals when correctly given may be interpreted correctly or incorrectly. So the signals correctly registered on the retina and reported to the brain may be incorrectly translated and interpreted, thus resulting in an error, an illusion.

Place a man and a dog side by side at a distance of 20 feet, and any person with an eye capable of distinguishing them will be able to tell which is on the right, which on the left. The eye is not easily deceived as to position at right angles to the line of vision. Let the man advance 5 feet; it is easy to tell that the dog is farther away than the man. Next, place the man at a distance of 100 feet, the dog at 105 feet; it is not so easily decided as before, although mistakes are rare with a normal eye. But at 500 and 600 feet, respectively, it is less easy, although we can still tell which is to the right and which to the left. The images formed on the retina by the same object at different distances are very similar, differing only in size and distinctness. For this reason it is difficult to judge of distances, requiring much practice. A person standing on a straight strip of railroad is rarely able to tell whether a distant train is approaching, or receding, or at rest, so slight is the change in apparent size from which the distance is to be estimated. Upon the sea it is very difficult, without long practice, to judge of distances.

As a curious instance of inability to judge of distances, and hence of the direction of horizontal motion, may be mentioned that of the governer of a steam engine. At a certain distance (say 50 feet) the eye will seem to see the balls turning in a certain direction, but on next looking at them this motion seems to have changed to the reverse, and after several alternations the mind becomes perplexed, and finally is able to see them turning either way.

An outline drawing of a cube may be made to look like the interior or exterior at will at a considerable distance; the real cube can be made to do the same. Shading, perspective, etc., are resorted to by the artist to give the idea of distance.

In the matter of *direction* deception is not so easy as in distance. Our experience tells us that if a person hits us in the back with a ball he is probably *behind*, not in front of us. The object seen lies in the same direction as that from which the light comes when it enters the eye. If by any means the direction of the ray has been changed between the time when it left the object and the time when it reached the eye, this rule is violated, and deception results. When this change is effected by the reflection it is attended with more or less loss of light, sometimes with distortion, and a little experience leads one to suspect a reflecting surface. If the mirror is very perfect, the most careful person is liable to be misled. The well-known "ghost" is due to the reflection of a strongly lighted figure from a plate of unsilvered glass. Many of the best tricks, with floating heads and the like, are arranged with mirrors. No illusions are more perfect than those produced with mirrors.

Refraction always changes the apparent place of an object, so that we seem to see the sun after it has gone below the horizon. A more striking but less frequent phenomenon of refraction is that known as *mirage*. Refraction also affects the color of an object.

The media through which light passes has more or less effect upon the ray. In a fog objects are dimly seen, the effect resembling that due to distance, hence objects look larger, for the eye judges of the size of an object by multiplying the size of the image or impression received by the square of the distance, while the latter is estimated from the indistinctness of the object. In the fog the apparent distance is increased, but the eye interprets it as due to the opposite cause.

On looking at the photograph of a tree, a church, a monument, or a pyramid, it is not possible to form a correct idea of its size unless a man or animal is seen in the same view with which to compare it. In nature, especially on land, the intervening objects that lead up to it give the data on which to calculate the distance. Where none intervene, as in looking from peak to peak, the eye must depend on distinctness, and where the air is very clear and transparent, as in Colorado, distances seem less than they are.

If the object is seen through transparent, but colored, media, the form remains true, but the colors are changed.

On looking directly at the loop or curve of an incandescent lamp it is frequently difficult to distinguish its form, the whole loop being radiant and dazzling, while its reflection is so much less brilliant that the form of the carbon is easily discovered. A wire or bar of iron looks much larger when red hot than when cold for the same reason, and a fire at night seems nearer, owing to its brightness, than in the day.

No better proof is needed of the fact that the eye does not and cannot measure distance, but only gives more or less imperfect data from which the mind calculates the distance, than the child's efforts to grasp the moon, and of the dog that bays at that distant luminary which looks so near; nor can any of us, with our naked eye, estimate the relative distances of the sun and stars.

The shape and color of an object are all that the eye alone can report with tolerable accuracy, but by experience we learn to distinguish the texture of substance, the nature of surfaces, and many other things that belong more properly to the sense of touch. We distinguish satin from velvet and wool from cotton at a glance. The painter's art largely consists in deceiving the eye; in so mixing and blending his pigments that they produce the same impression as stone and wood, or earth and trees, or flesh and blood would do, and the greater his skill, the more perfect the deception. The imitation is rarely so perfect as to deceive the experienced, and yet the pleasure derived from the imitation exceeds that given by the reality, just as misery and suffering, when well depicted on the stage, give pleasure, but the sight of the reality gives pain.

In many things the mind enjoys being deceived, and optical illusions give us pleasure, so much so that those who are capable of completely deceiving this acutest of our senses get well paid for exercising their talents. H.

The Flying Machine Problem.

Mr. Paul Mayo, of Lausanne, Switzerland, has lately printed a monograph on "Sustaining bodies in space by motive force," and writes us as follows on the subject:

"The wings of the common fly vibrate at the rate of 330 strokes per second; those of the mosquito about 2,000 times per second; therefore, according to the formulas which I have established, a number of common flies, weighing altogether 20 tons, and 130 tons of mosquitos, would require about 1 horse power to sustain themselves in the air. It is encouraging for the many whom the question of the flying machine interests, to know that in certain conditions an enormous weight may be kept above ground by means of a very small power exerted, as in the case of the mosquito, the fly, etc. These conditions can be easily obtained, and in this respect we are placed in as good a position as nature. Any one can obtain iron in such form that it will float on water. A very good size of wire to construct floating iron rafts is $\frac{1}{20}$ of an inch in diameter. The wire is to be scraped with sand paper and well washed with soap water. In this wise rafts are obtained which can bear a charge nearly twice their own weight without sinking, *i. e.*, much better than poplar would do—one of the lightest of all species of woods.

"During the study of this question of sustaining forces in space, I came many times to what seemed to me a strange conclusion; for instance, that any piece of heavy metal must float on *perfectly still* water. But as it is impossible to have *perfectly* still water, the property is subordinated to certain conditions."

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DR. LE PLONGEON'S LATEST AND MOST IMPORTANT DISCOVERIES AMONG THE RUINED CITIES OF YUCATAN.

(*Continued from page* 263.)

The mural paintings upon the walls of the inner room of the Mausoleum of Chaacmol are separated into tableaus divided by horizontal lines. Each figure is about nine inches high, and as we have many reasons for supposing that these people were about our own size, perhaps a little bigger, we may say that the artist allowed one and a half inches for each foot. The outlines are bold, decided, and graceful, but the tints are flat, and the perspective was evidently not understood by those artists, except in a very limited manner. Nevertheless, as these are the only actual mural paintings that we have found during a ten years' study in the ruined cities of ancient Yucatan, we consider them of remarkable interest and value, being the last remnants of the art of painting (mural) among the Mayas. Religious ceremonies, battles, and domestic scenes, as well as grand processions, are depicted on that wall—a fading gem of antique art.

In 1875 Dr. Le Plongeon made tracings on transparent paper of the best preserved tableaus, and from these tracings a facsimile of those portions of the wall was made and lent to the Metropolitan Museum of Art, Central Park, N. Y., where they are now on exhibition. At the time we made these tracings (1875) one part of the precious wall was covered with the dirt of centuries; for, alas! these palaces are now the abodes of bats and swallows, that build their nests in small, square holes on the sides of the roofed arch—holes that supported the ends of wooden beams of choicest wood, polished, and sometimes carved. We had not then with us the means of cleaning those paintings, but now (1884) came prepared to cleanse and copy all that could possibly be saved. To our grief, we at once saw that some one had tried to clean the wall by *scratching* off the dirt. In answer to our exclamations of disgust, some of the soldiers that escorted us in our expedition said: "Oh, yes! that gentleman who came two years ago did it; he scraped it with a machete, and said: 'Look at this ugly little old woman!'" We said: "What! did M. Charnay do that?" "No, it was M. the *Consul Americano*, who accompanied M. Charnay." We left the wall as we found it; it was no longer in a condition to be copied.

The jambs of the door of this funereal chamber, and the square pillars that are against them, forming, as it were, a triple jamb, are covered all over, on every side, with warriors dressed and armed. The work is perfect, and painted in bright colors. The figures are nearly life-size, and Dr. Le Plongeon has made moulds of all, they being important to show the various types, dresses, insignia, and weapons. The faces, whether sculptured or painted, are in profile, not because the Maya artists did not know how to make a full face, for the sculptures in the round prove to the contrary, but because they preferred it; just as they did the triangular arch to the round, which they knew well enough how to make, for on the very wall just mentioned domed buildings are painted. I must also say that the aborigines are generally better looking side face than full face, and they must have been well aware of the fact; even though the beautiful Maya women, say the historians, did not use a looking glass to see what position best suited their face; only the men indulged in that vanity.

The most interesting remains of the art of sculpture among the Maya are the *sapote* beams that form the lintel of the funereal chamber. Unhappily, the carving of that lintel has been much defaced by individuals who have hacked it with machetes. What remains shows how exquisitely those Mayas could carve wood in most intricate designs.

Dr. Le Plongeon has made moulds of the lintel, as much for the historical teaching it conveys as because it is the last specimen of wood carving among the ancient Mayas. On examining the closeness and depth of the lines, we find it hard to believe that the artist had no finer tools than those of obsidian or silex; the intaglios are nearly three-fourths of an inch deep, and *sapote* is very hard wood. In making the mould of these carvings Dr. Le Plongeon discovered that the surface of the wood was covered with a thick coating of a yellowish gummy substance, that when rubbed with a wet brush yielded a thick, froth-like soap, which led us to suppose that the substance, whatever it may be, was used by the artist to preserve the wood from insects and protect it from atmospheric influence.

Plate 1.—SCULPTURED STONE WORK.

In the year 1875, when we unearthed the statue called Chaacmol, now in the museum at the capital of Mexico, Dr. Le Plongeon discovered a monument that he considered of great importance, and, returning here, he decided to examine the interior. He succeeded in measuring the original dimensions, though it was reduced to little more than a shapeless pile of stones, with broken stairs on one side, and covered with bush. The structure was square, its four sides faced the cardinal points, and on each were thirteen stairs, three meters eighty centimeters wide, that led to the top platform, exactly four meters above the ground, and sixteen meters square. In the center was a large stone slab, on which formerly was a statue of a man about double life-size, in a reclining posture, like the statue Chaacmol.

The fragments of this gigantic statue are scattered at the base of the mound, only the lower limbs being entire, which show us the position it had. On the sides of the monument, in the spaces between the stairs, there were finely sculptured stones.

Only a few are now in place, and Dr. Le Plongeon has made photos and moulds of them. The largest is one meter twenty-five centimeters high, and one meter thirty-five centimeters wide. It is a human face within the distended jaws of a snake, and on the sides of the face are Egyptian letters that give the name Cay Canchi. [Plate 1.]

On the north side of the mound, in a part where there was neither sculpture, stones, nor stairs, we set our men to open a trench one and a half meters wide, to reach the center of the mound, the interior of which consisted of unhewn stones, piled one over another, and mortar that seemed to have been poured among them. As the work proceeded, the sides had to be propped with a strong palisade made of tree trunks cut from the surrounding bush, to prevent the loose stones from falling on the laborers. [Plate 2.]

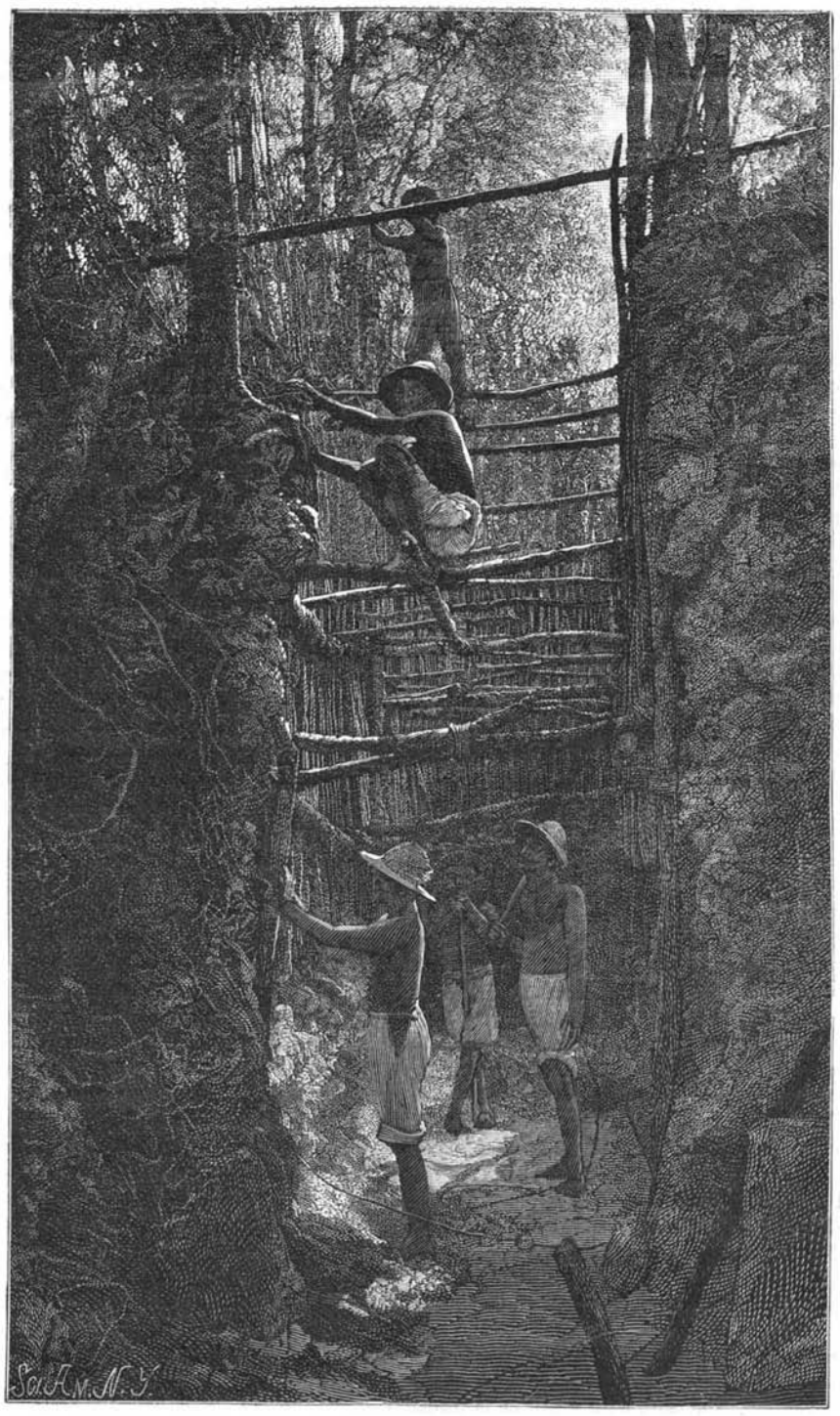

Plate 2.—HOW THE EXCAVATIONS WERE MADE.

Oxalic Acid.

Oxalic acid we obtain mostly from wood sorrel and the sorrel tree, but it is contained in many other substances. It is manufactured in large quantities from heated sawdust in connection with hydrate of potassium, etc. Oxalic acid is in colorless and odorless crystals, with a strong sour taste. It is soluble very slowly in eight parts of cold water to one part of oxalic acid, but is easily soluble in hot water. It is very poisonous, and many cases of poisoning have already occurred in lithographic establishments by mistake when regular or common salt should have been used. It is a sure remedy, when not too late, to give the person who has swallowed oxalic acid large draughts of water mixed with white chalk.

Oxalic acid is used for preparing stones for engraving, and is greatly preferable before etching with nitric acid when machine ruling is to be applied on an engraving. It only requires a little more weight on the diamond, as the oxalic acid produces a layer on the surface of the stone, which the diamond has to cut through; otherwise, all lines would not have the necessary strength and would look broken; but when the diamond has cut through the layer, the lines will print sharper and more distinctly than in the etching with nitric acid. It also prevents scratches on the stone from taking ink. Oxalic acid is also used for keeping the edges of the stone clean in the steam press. A solution of ten parts of dissolved gum arabic, one part of oxalic acid, and one part of phosphoric acid is the best preparation for stopping out lights and correcting errors on engraving stones. This acid is not effervescent, and does not spread out as nitric or muriatic acid does. It is also the best acid to take off any dirt or scratches from old engravings; but very great care must be taken that no work is touched that is to remain on the stone, for where the oxalic acid is once applied the ink will not easily take hold again. Therefore it shows what is a good remedy for one thing is a very dangerous thing for another.—*Lithographer.*

An Enormous Puff Ball.

My friend, Prof. R. E. Call, has handed me a photograph of a puff ball, the largest on record. The fungus was found by him in Herkimer County, N. Y., in 1877, and as it was impossible to preserve it, careful measurements were made, and photographs of it were taken. It was irregularly oval in outline, and much flattened, instead of approaching the spherical form, as is common in the large puff balls. Its largest diameter was five feet and four inches, its smallest four feet and six inches, while its height was but nine and a half inches. In reference to it Professor Call described it as "much larger than the largest wash tub we had at home."

The specimen undoubtedly belonged to the species known as the giant puff ball (*Lycoperdon giganteum*), and it was by far the largest of any of which I have been able to find measurements.—*C. E. Bessey, Amer. Naturalist.*

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DYNAMITE THROWN FROM CANNON BY POWDER.

On the 22d of April a trial was made in the vicinity of New York of firing dynamite from a 12 pound Rodman gun with a charge of powder. The system employed by the inventor, Mr. F. H. Snyder, to whom we are indebted for the following particulars, consists in the insertion of a buffer combination between the powder and the dynamite, so that the buffer will take up the shock without exploding the dynamite.

The trials were made in the presence of a number of spectators, and following, as they do, so closely upon the trials of the pneumatic dynamite gun, have excited great interest, particularly on account of the simple manner in which the problem has been met.

By referring to the accompanying illustrations, it will be seen that no extra appliances whatever are required as regards the gun. The dynamite can be loaded in ordinary guns, such as exist at the present day, and is fired in the usual manner with powder. The great advantages of such a system are obvious, since it conforms in every respect with the practice of firing solid shot, and is equally applicable to naval and land operations. In our illustration Fig. 1 represents an ordinary gun with the naval projectile in position. The latter consists essentially of the dynamite compartment, B, and the wooden shank, A, provided with wings, C, to guide it when it strikes the water.

In addition to this, and constituting the principal features of the invention, are the means provided for reducing the shock when the gun is fired. These consist, in the first place, of the sabot shown in Fig. 2. This is built up in three sections of wood or *papier mache*, W and S, between which are located leather washers with overlapping sides, L. In front of the third section, W, is placed a convex disk of copper, F, which bears against the former at its outer edge, the copper in turn butting against a plug, X. The whole is bolted together, all the disks, however, fitting loosely on the bolt. This arrangement acts both as a gas check and as a buffer, the washers, L L, performing the first office, and the copper disk the latter. This will be understood by stating that the copper disc is of smaller diameter than the bore of the gun; thus, when the latter is fired the shock is taken up by the disk, which becomes flattened out, thereby overcoming the inertia of the projectile gently.

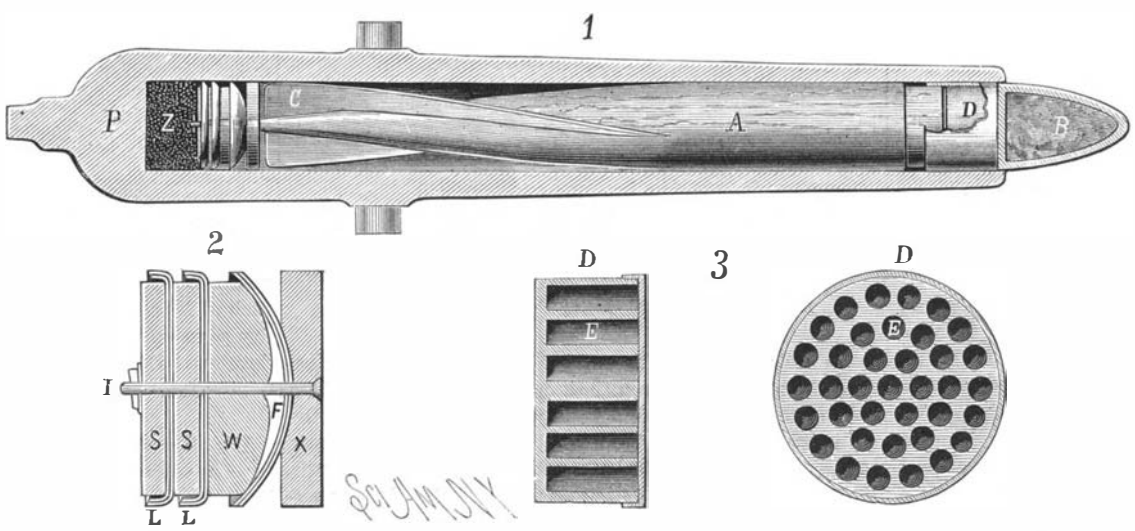
There is, however, still another provision made to reduce the shock of a sudden discharge, which consists in placing a cushion between the end of the shank, A, and the dynamite chamber, B. The latter is formed into a hollow cylinder at its rear end, passing over the shank, A, like a sleeve. Into this hollow cylinder there is placed the buffer, D, shown enlarged in Fig. 3. This is made of India rubber, and has a series of holes, E, running longitudinally nearly through, a cap fitting over the end to close the holes. When the projectile is in position the end of the shank lies against the bottom of the India rubber buffer, and the cap of the latter in its turn against the dynamite compartment, the shank, A, being recessed a short distance behind the sleeve so as to allow free motion. When the gun is fired the shock is partly taken up, not only by the rubber, but also by the air which is confined in the holes, E, and which cannot escape, the device making a very efficient cushion, which experiment has shown to be all that is necessary.

For land purposes the projectile is considerably shorter than the one shown in the illustration; it is cut off close behind the dynamite compartment, and lies well down in the gun. Thus, for an 8 inch gun the naval projectile has a length of about 9 feet, while the land projectile is about 3 feet. In the experiments lately made, projectiles were fired from a Rodman 12 pounder, 4·62 inch bore, in which quick burning "FF sporting powder" was used, and which threw a charge of 5 pounds of dynamite three-quarters of a mile; the dynamite buried itself several feet in soft mud without exploding. Subsequently, when firing a naval projectile, the latter ricocheted a long distance before sinking, thus proving itself capable of striking a ship at the water line with certainty

Another important point observed is the fact that the recoil of the gun is greatly diminished by the interposition of the cushions, which property will commend itself particularly in naval guns.

As yet no official tests have been made of the system, but the United States Government has invited thei nventor to make a trial of it, which will take place at Sandy Hook as soon as arrangements can be made.

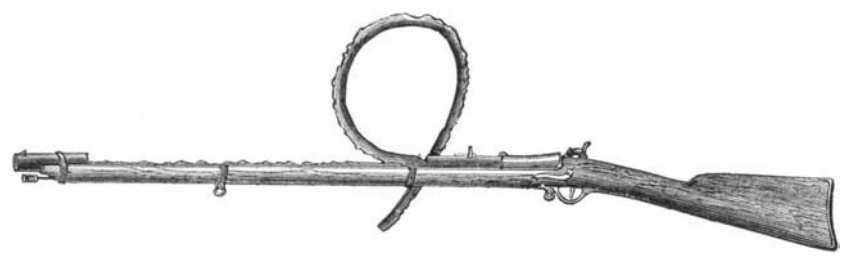
The simplicity of the system must commend itself, requiring no change in the cannon, and entailing but a small cost in the other appliances used. As a weapon of destruction in warfare, dynamite is as yet an almost unknown force, but if a charge can in this way be thrown five miles many old ideas will have to be discarded.



DYNAMITE CARTRIDGE THROWN FROM CANNON BY POWDER.

THE BURSTING OF GUN BARRELS.

We give below some extracts from a letter of Mr. Munn Davis, of Nebraska, who writes us upon the subject of the bursting of gun barrels, and criticises some articles which have been published upon this subject in some of the sporting papers and in *Harper's Weekly* by Mr. W. McK. Heath, of Philadelphia. Mr. Heath has been making some experiments, and he has spent many words in describing them. But the point which is of most interest, and which would render his experiments of any value, he seems carefully to have avoided, namely, the cause of the bursting of gun barrels. He passes over the subject with a single sweep of the pen, and says that it is the jamming of the projectile against some obstruction in the muzzle of the barrel. This may be all very true, but it scarcely explains anything, and least of all the real action which takes place



THE BURSTING OF GUN BARRELS.

Fig. 1.

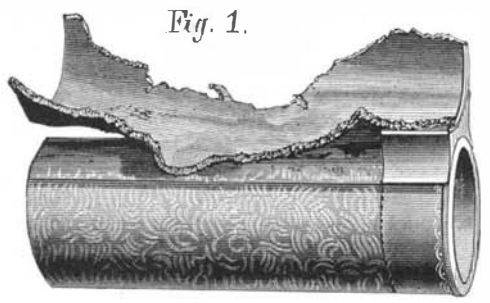
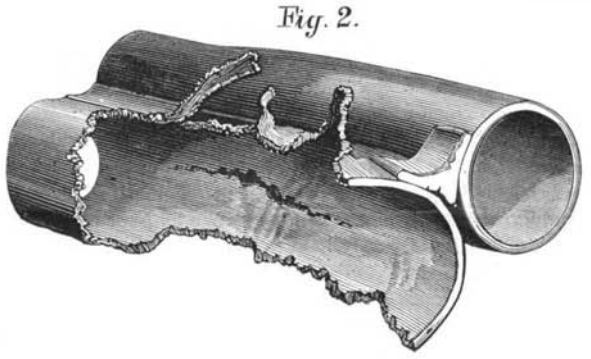


Fig. 2.



THE BURSTING OF GUN BARRELS.

in the barrel before and during the explosion. Mr. Heath's experiments have consisted in discharging guns which had been obstructed at the muzzle by all sorts of different substances, such as mud, sand, water, snow, stuck bullets, etc., and of whatever value the experiments may prove to be, they show one fact very conclusively—that it makes little odds whether a barrel be obstructed with a bullet or simply with wet sand; in either case the result may be equally destructive.

If Mr. Heath's theory is true that the bursting is due to simple jamming of the projectile against the obstruction, we do not see how he explains what has become of the air which filled the space between the projectile and the obstruction before the discharge, nor how he accounts for that total wreck of firearms which we so often hear of. Mr. Davis, in his communication, has elucidated this point, we think, in an experience which he relates, and in which case the bursting must have been due, not to the jamming of the bullet against the obstruction, for this does not seem to have occurred, but to the almost instantaneous compression of the air in the barrel between the cartridge and obstruction. He says:

"During the summer of 1871 I saw in Topeka, Kansas, among a lot of government arms that were being overhauled and cleaned, a "needle gun" which had been burst by a "stuck" ball about four inches from the muzzle. The upper part of the barrel had been blown up and back, the rupture commencing at the rear end of the "stuck" ball; the end of the broken section had struck the barrel itself at a point immediately in front of the back sight, and with such force as to dent it about one-sixteenth of an inch in depth, and had then glanced off to the right side and continued its course downward some three or four inches below the lower line of the stock. The "stuck" ball was still in the gun, and showed *no signs* of having been struck by the projectile, except that in one place it was slightly battered over the jagged edge of the ruptured barrel. If it was not the compressed *air* which caused this break, what force was it which could split the barrel from the rear end of the "obstruction" to the point of indenture, just in front of the back sight, a distance of about fifteen inches? The accompanying sketch shows the appearance of the gun at the time." Fig. 1.

"I also send a fragment, 2½ inches long, taken from the muzzle of a Piper breech-loading shotgun, the right barrel of which burst from a mud obstruction at the muzzle. The barrels are Damascus steel, and have a patent appliance at breech and muzzle, by which they are said to be "re-enforced." It is evident in this case that the shot struck the "obstruction," and then "wedged" to such an extent as to cause the rupture, as you will readily perceive the black line of lead still sticking to the barrel."

"In most breech-loading shotguns the diameter of the shell chamber is perceptibly larger than that of the remainder of the barrel, and it is customary to use a No. 8 wad in loading a 10 gauge brass shell. This gives what is commonly called a "force" wad, *i. e.*, a wad which will fit tightly the entire length of the barrel; and, to a common thinker, it seems as though the wad over the shot would be sufficient to remove the "obstruction," provided it was not jammed into the barrels so tight as to prevent the escape of air. Some think the break is caused by the shot jamming against the "obstruction," and indeed this seems to be the case with the Piper gun."

"A few days since I took occasion to test the matter, with the following results: Procuring an old muzzle-loading shotgun (No. 14 gauge), I loaded each barrel with four drachms of Hazard gunpowder (FG) and two No. 12 Ely Bros.' pink edged wads. In the right barrel two of the same kind and size wads were placed about two inches below the muzzle, and in the left barrel I put one wad down about the same distance from the muzzle, and on top of it some *mud*, crowding it against one side of the barrel so as to leave clear about half the space. The gun was then discharged, and the "obstructions" in both barrels were blown clear without injury to either barrel. The piece was loaded again in the same manner as before, and mud put in the muzzle of each barrel, but a small aperture was made through the "obstruction" in the left barrel. The result of the discharge this time, however, was the bursting of the right barrel, where the obstruction was solid, while the left barrel, in which the obstruction had a small aperture, remained intact. The effect upon the right barrel may be seen in the illustration, Fig. 2. *There was no shot in either barrel.*"

"On different occasions I have fired a rifle when the ball was so tightly lodged about ten or twelve inches from the muzzle that it was impossible to move it with the rammer, and I did on one occasion fire a *ramrod* from a shotgun when the wad had "turned," and thus wedged it in the barrel so that it could not be moved, but have never had a gun burst in my hands yet."

A 30 inch barrel probably has over 24 inches of air space between the charge and the obstruction.

The sudden compression of this air not only wedges the obstruction tighter, which prevents the escape of the air, but will generate an immense pressure, by compression, liberation of latent heat of compression, and the escape of the products of combustion by windage, of from three to four thousand pounds per square inch, before the charge could reach the obstruction.

This great pressure is made up from say 60 or more volumes of air instantly compressed into one volume, which will give about 450 pounds. The heat liberated by this amount of compression is theoretically over 5,000° Fah., which will add a thousand pounds more to the pressure. This is upon the supposition that there is no windage or leakage of the products of combustion of the charge past the bullet or wad, which however is not to be admitted.

The windage during the first few inches of the movement

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of ball and wad, when the pressure is at its greatest behind them, must be very considerable, and in some cases is no doubt enough to add one or two thousand pounds to the pressure above enumerated. This pressure is greater than the thin and possibly defective muzzles of some shotguns or muskets will bear. Any opening in the obstruction that will give vent to the compressing air without having to overcome the momentum of a solid body will very much modify the liability of rupture at the muzzle.

Deep Water Fishes.

Remarkable additions have been made to our knowledge of the animals inhabiting the profound abysses of the sea within the last few years, and almost the last few months, by means of the system of dredging persistently and regularly carried on from government vessels.

One of the results has been to reveal the fact that a remarkable group of fishes—*Malacosteus*—have their home only in those hidden depths. We cannot call them a "group" in respect to ichthyological classification, for they are of very diverse types; it is only that certain very strange features are found common to them all, and these features are doubtless associated with the abysmal region which is their home.

The most striking of their peculiarities of form is the disproportionately enormous development of the jaws and jaw apparatus. The skull, the true head of the fish, is quite remarkably small, while the parts representing the maxillary structures of other fishes are elongated to such a degree that so far as they are concerned one could easily swallow an object much larger than his own body, several times as large, in fact. A glance at the figures shows this much better than many words of description. What object is served by this peculiar form is not evident, and yet it apparently pertains in some way to the depth at which they live.

The feeble development of bone cells, from which has come the use of the name *Malacosteus* (soft bones), was suspected by some to be accidental; but now it is found that it pervades the group to a certain extent, though more completely shown in *Malacosteus* than in any of the others, and associated also with a softness and looseness of the other tissues. The suggestion has been made that this lack of firmness and solidity may be due to the great pressure borne by the fishes at such enormous depths; that this tends to sustain the tissues and hold them in place, thus giving the animal power to act firmly and strongly: but such a supposition can scarcely be maintained.

In fact, this matter of pressure upon living tissues being caused by great depth, or any depth whatever, has been sadly misunderstood. The theory is totally untenable, and it is singular that it is so constantly brought forward and urged. That pressure must necessarily come upon any cavity, either filled with air or not, is certain, the pressure being proportionate to the depth. This has been shown most strikingly in connection with the attempts of the Fish Commission to lower electric lights to a great depth. The lights have been extinguished invariably, because it has been found impossible to prevent the entrance of water into the glass vessels, even when the points of insertion of the wires have been secured with every care available; it seemed as though the water had been forced through the pores of the glass itself by the pressure. Is it to be supposed that any living tissue could retain its vitality under such a strain? And still again, any motion whatever by the animal would be an absolute impossibility. If he was placed in a vise, no power of the screw could "set" him so hard and fast as the pressure of say 2,000 fathoms.

The simple fact is, that every portion of the body of the fish, every single microscopic cell, is permeated by fluid, in perfect correlation with the surrounding water; and as the internal and external reactions are equal, there are no differences of tension, and of course no pressure is manifested or felt.

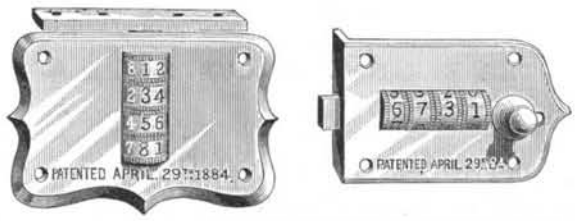
We cannot believe, therefore, that the conjecture as to this cause having anything to do with the looseness of structure has any foundation in truth. A much more rational idea appears to be this: That the gloomy depths of the sea water are totally and constantly at rest; all is quiet, and motion is performed with so much freedom and ease, that firmness of tissue, either osseous or muscular, is not required.

And with this quiescence of the water in their home is associated another characteristic which pervades the deep sea group to a certain extent, which is the great slenderness and delicacy in form of the fins and other appendages, and in some instances even of the posterior portion of the body itself, as strikingly shown in *Macrurus globiceps*. The fins themselves are often only indicated in position by exceedingly delicate fibers or rays without connecting membrane.

Another strange, and as yet scarcely intelligible, feature shown by many of these fishes, but not by all, is the presence on the head or along the sides of curious rounded masses, "showing mother-of-pearl colored bodies embedded in the skin." These have been conjectured to have some relation to the eyes, or to sight, but there is apparently small ground for such a belief. There is no reason to think that they have any connection with the nerves of vision, nor have they the structure which could render such a connection of avail. Dr. Gunther suggests that they may be "accessory eyes," or may be producers of light from phosphorescence. Even a suggestion from him is worthy of respect, but what these organs could achieve in the intense darkness of the sea bottom must be infinitesimal in effect. In none of the other types is this strange feature more fully developed than in *Malacosteus*. Almost all of these fishes show evidence, from the nature of their jaws and teeth, of being strongly voracious in their habits and rapid in movement, and it is not impossible that phosphorescence, if pertaining to these "mother-of-pearl" bodies, might serve as a lure for their prey. Perhaps this is as probable a conjecture as any other.

IMPROVED PERMUTATION LOCK.

The accompanying engraving illustrates permutation locks intended for trunks, valises, satchels, wardrobes, bureaus, drawers, desks, etc., and for which letters patent were recently issued to Mr. W. M. Brooke, of Brooklyn, N. Y. The arrangement of the lettered disks is such that



IMPROVED PERMUTATION LOCK.

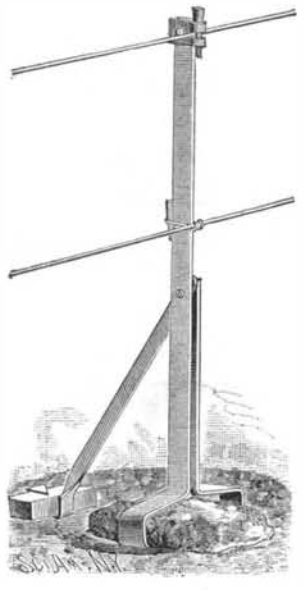
different combinations can be conveniently formed. The superior excellence of these locks lies in the fact of their being burglar-proof and keyless, and also because of their simplicity of construction, durability, strength, and ease of management.

Messrs. Sias, Swasey & Co., of 78 Broad St., Room 14, New York, are the sole managers, and propose to manufacture pad locks and to dispose of British and Canadian rights to manufacture, and also privileges for manufacturing in the United States, except for pad locks.

This is a substantially meritorious and ingenious invention, worthy the investigation of those interested in this branch of manufacturing industry.

AN IMPROVED FENCE POST.

The annexed illustration shows an invention recently patented by Messrs. G. Moll and F. Hottes, of Mascoutah, Ill. The post is made of bar or band iron bent to form a flattened loop at the lower end, and then extended upward to about the middle. The loop is formed to receive a block of stone or a brick. The upper end of a brace is pivoted to the post as shown; the lower end is bent to form a loop for receiving a brick or block. Loosely held to the upper end of the post by a rivet is a U-shaped clip which may be swung to opposite sides of the post, and which is cut away at the head so as to form two loops projecting from the edge of the post. The wire is held in place by a pin passed through the loops. The second wire is held by a U-shaped wire having hooks



MOLL & HOTTES' IMPROVED FENCE POST.

at the ends of the shanks, and held to the post by a wedge-shaped pin driven between the cross piece and the post. The post is sunk in the ground as far as may be necessary, the earth bearing upon the blocks in the loops holding it firmly in place. By pivoting the brace and clip, they may be swung to opposite sides without digging up the post. Our engraving shows the post ready to be set in the ground.

Poisonous Sleep Producers.

The death of a medical man—Dr. John Middleton, late Surgeon-major in the 2d Life Guards, but at the time of his decease a practitioner at Stockton—will again draw attention to the mischievous and, as we believe, wholly indefensible practice of giving and taking such depressing narcotics as chloral and bromide of potassium as a remedy for sleeplessness. Sleeplessness is always wakefulness in one or more of its multitudinous forms, and the recourse to narcotic poisons for its relief is utterly unscientific and deplorable from a therapeutical point of view. It is as clumsy in theory—in so far as it can be said to have a theory—as knocking a man down because he needs rest. What is it that prevents the natural and physiological rest of the body at rhythmical periods? The brain is as truly a part of the body as the stomach, and it is as much a fault of the organs of the mind to prevent sleep by mental worry or wakefulness as it is a fault of the stomach to render sleep impossible by bad digestion. No intelligent practitioner dreams of narcotizing the nerves of the gastric organ to promote sleep. Why, in the name of common sense, should any medical man for an instant think it legitimate to narcotize the brain because *it* exhibits some disturbing irregularity in its functions?

Sleep is not a special prerogative of the brain. Every organ sleeps, and general sleep is the aggregate of many sleeps. It is time to protest against this clumsy procedure. If we do so warmly, it is because we feel that the mistake is of common making. It is so much easier to write a prescription or make up a bottle of medicine or a box of pills with one of the rank poisons that mimic sleep, and as they do so deprave cerebral and nerve tissue, than it would be to search out the real and active cause of wakefulness. When will the progress of professional enlightenment reach that point at which all those cloaks for ignorance that depend for their significance on the negative *in* are ostracized from our nomenclature? Dr. Clifford Allbutt has just pleaded forcibly and eloquently for the discarding of that wondrously silly word "indigestion." Will no spirited scientist help to exorcise the haunting folly that clings to the term "insomnia"? All terms with *in*, negative, imply ignorance on the part of those who frame and use them, and, which is worse, are content with the state of knowledge arrived at, or are too indolent to extend and improve it. Who shall sound the depths or measure the range of the stupendous unknown over which the audacity of a specialty and the apathy of a profession conspire to cast the veil of "insanity"? There are more than a score and a half of *known* causes or forms of sleeplessness, each one requiring direct and specific treatment, and yet, as by common consent, the profession sanctions the abuse of such drugs as chloral and bromide as "poisoned sleep" producers. No medical man is justified in undertaking the treatment of his own maladies. It is impossible that he should so far step out of himself as to be able to form a reasonable judgment of his case *objectively*; and no practitioner has the justification of science for the recourse to narcotics as remedies for sleeplessness except when an exceptional pain is the accidental disturber of a sleep function, or a habit of wakefulness may be broken by an occasional dose of the stupefier.—*Lancet.*

An Improved Photo Developer.

At a recent meeting of the Society of Amateur Photographers of New York, Mr. H. J. Newton communicated a formula for an improved developer for gelatine plates which he had found by experiment to be particularly valuable in the development of instantaneously exposed plates, and also to produce negatives of a superior color and quick printing quality. He makes two stock solutions in the following proportions:

Stock No. 1.

Water	1 ounce.
Dried carbonate of soda in which the water has been driven out	48 grains.
Pure carbonate of potash	48 grains.

Stock No. 2.

Water	1 ounce.
Sulphite of soda	48 grains.

To develop a 5 x 8 plate with a drop shutter exposure he pours in the graduate ¾ of an ounce of 6 drachms each of No. 1 and No. 2, and then adds 1½ ounces of water and 6 grains of dry pyrogallic acid. It may be mixed half an hour before use if desired. The sulphite of soda keeps the solution clear.

If the exposure has not been too long, the developer will rapidly bring out the image; the development should be carried on until the whites of the shadows have turned a steel gray color.

If the plate has been overexposed, the developer should be diluted with water and restrained with two or three grains of bromide of sodium to each ounce of developer, which may be in the form of a 10 per cent solution.

If the plate has been known to have been greatly overexposed, development should be commenced with 1 drachm each of No. 1 and 2 to 2¾ ounces of water and 3 grains of dry pyro, adding a little of each at a time should the picture develop too slow.

Pilocarpine for Deafness.

For all recent cases of deafness due to labyrinthine disturbances, whatever the primary cause may have been, Politzer tries the subcutaneous injection of a two per cent solution of the muriate of pilocarpine. He injects four drops at first, and gradually increases the dose to ten drops daily. He gets fairly good results in about one-half of the cases. I have seen three cases of persons totally deaf, who, after being treated in this way, could hear and understand loud speech spoken at the distance of a few inches from the ear; and Politzer has had one case of perfect recovery of the hearing after it had been absent for three years, and several other very satisfactory results following the use of this drug. He is about to publish the results of his experiments with the history of some of the cases. It is not known how pilocarpine acts in these cases, but the benefit derived from its use is certainly great in some of them. *Berlin Med. and Surg. Journal.*

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ENGINEERING INVENTIONS.

A balanced slide valve has been patented by Mr. Ashbel Welch, of Lambertville, N. J. This invention covers a simple, practical, and economical arrangement whereby all sticking of the valve is prevented, the cylinder may be relieved of water of condensation, and the uniform wear of the valve face and seat is assured.

A car coupling has been patented by Mr. Edward L. Raynsford, of Susquehanna, Pa. The coupling hook and drawbar are supported by a bearing plate kept in place by a collar and provided with cross head ends sliding in bearings attached to the car frame, the whole making an improved device to promote convenience and safety in coupling and uncoupling.

A coal chute has been patented by Mr. Joseph E. Clifton, of Geneseo, Ill. The invention covers an improved arrangement of the latch for fastening up the balanced apron of the coal chute, also of a brace attachment to the door in connection with the balanced apron, and an attachment to facilitate and insure the latching of the door, etc., the whole making an improved arrangement for coal chutes used for coaling locomotive tenders.

A car brake attachment has been patented by Messrs. Eli M. Holcomb, of Bay Springs, and Frederick E. Miller, of Eveline, Mich. The invention consists in the combination with a ratchet wheel and a beveled pawl pressed against the wheel of a vertically movable plate with a downwardly projecting wedge and a prong surrounded by a spring, which presses the wedge plate upward, the parts being protected from rain and snow, and the device enabling the brake to be quickly released.

A marine engine governor has been patented by Messrs. Alexander H. Bell and Aspinwall Fuller, of New York city. A two part spherical valve seat is placed in the shell, provided with flanges to keep it in place, and with perforations for the passage of steam and the valve stem, a spherical valve with perforations for the passage of steam and a weighted valve stem to control the valve, with a stuffing box and flexible connecting base to prevent steam from escaping around the valve stem.

MECHANICAL INVENTIONS.

A lifting jack has been patented by Mr. Erick J. Qvarnstrom, of Norway, Mich. The invention consists of improvements in the construction of screw jacks arranged to shift the hoisting screw after the load is raised, to move the load while supported on the screw, to simplify the parts, and make jacks that are substantial and reliable.

A vise attachment has been patented by Mr. Charles H. Eddy, of Auburn, N. Y. The under side of the vise has two jaws, one stationary and the other adjustable, both connected by a swiveled adjusting bolt, and with their inner surfaces suitably made to bite or hold on the opposite sides of the rim of the wheel it is desired to attach the vise to.

An oil cup feeder has been patented by Mr. James E. Worswick, of Montgomery, Ala. The motion of the machine where the lubricator is fixed causes a feeding pin to reciprocate in a tube, where it is loosely arranged, there being a removable collar at the upper end of the tube, and a removable perforated disk within the collar to form a bearing for the upper end of the pin.

A lumber trimming machine has been patented by Mr. Edward Heyde, of East Saginaw, Mich. It is an improved apparatus for raising and holding in position any one of a series of cutting off saws arranged in a bench over which boards are carried to have the ends trimmed square and to specified lengths, the saws being arranged for trimming to several different standard lengths.

A motor has been patented by Mr. Jacob Heckenlively, of Eureka, Kan. A weight is so suspended from a drum that, in descending by gravity, motion is given to a train of gears, which drive a shaft carrying a cam wheel, with which a machine may be connected by a pitman, a governor device pressing a brake lever against the cam wheel to control the speed of the motor.

A lubricator has been patented by Mr. Henry R. A. Boys, of Barrie, Ontario, Canada. The invention consists of an arrangement of an oil feeding cylinder and piston and a gauge cylinder and piston, so the outward movement of the piston to feed the oil from the oil cylinder shall cause a corresponding outflow of the gauging liquid from the gauge cylinder to measure the rate of feed of the oil.

A pressure regulator has been patented by Mr. Francis J. Freese, of Manchester, N. H. The object of the invention is to make an improved device for automatically regulating the pressure of liquids, gases, steam, etc., a plunger moving in a specially constructed cylindrical casing, so as to enlarge or diminish the openings by which the flow of gas, steam, etc., will be automatically controlled.

An oil cup has been patented by Mr. Perry Small, of Guaymas, Mexico. It is an improved oil cup with glass drip chamber, the latter being made by a partition plate, which is integral with the glass cup, the frame surrounding the cup having openings above and below the partition plate, and having at its upper end a suitable cap, the whole being simple, cheap, and not liable to get out of order.

AGRICULTURAL INVENTIONS.

A potato digger has been patented by Mr. Hans Nelson, of Waupaca, Wis. A scoop is connected with the rear end of a downwardly and inwardly curved beam, with which is combined a clearer, and clearer vibrating cams or wings on the axle of supporting wheels, the scoop being readily adapted to work deeper or shallower in the ground, as may be desired.

A grain header and harvester has been patented by Mr. Peter E. Drouet, of New Orleans, La. The front board of the cart is made in adjustable parts, the side bars are pivoted at their rear ends on a bar to which are secured the scraper roller, comb, reel, and driving mechanism, and as the machine is drawn forward the grain is removed from the heads of the stalks and received in the cart body.

A tongue rest, for supporting the tongue of a harvester and self-binder, has been patented by Mr. John Fisher, of Riley, Ind. In combination with the tongue is an upright frame in which is a slide with an inwardly projecting rod, around which a spiral spring is coiled, the whole making a device to relieve the horses from holding up the tongue and the weight thereon.

MISCELLANEOUS INVENTIONS.

A catamenial sack of improved form and construction has been patented by Mr. Charles H. Levy, of New York city. The frame can be made of metal, rubber, or bone, covered, and the pocket and pouch of rubber, leather, or waterproof fabric.

A telephone call and switch box has been patented by Mr. Edwin H. McFall, of Memphis, Tenn. This is a novel arrangement of switch and circuit in telephone boxes, having the object to maintain closed circuit at all times on lines connecting three or more instruments.

A hoisting device for vessels has been patented by Mr. Richard H. Purnell, of Rosedale, Miss. This invention relates more particularly to a special form of brake for use in combination with hoisting devices used on steamboats for lifting and adjusting the gangway or stage planks.

A velocipede has been patented by Mr. Charles M. Schaffer, of Louisville, Ky. The wheel and frame are made with one open side, to facilitate ingress and egress and give better views of surroundings, to facilitate mounting and starting, and to improve the appearance of the machine.

A leather and cloth varnish has been patented by Mr. Walter C. Gifford, of Brooks, Mich. It is waterproof and gives a polish, the composition consisting of alcohol, gum shellac, white resin, oil of turpentine, kerosene oil, oil of cinnamon, and lamp black in certain specified proportions.

A mucilage cup or holder has been patented by Mr. Stephen S. Harman, of New York city. The invention consists principally of a handle or stick fitted in the cover, provided at its lower or inner end with a sponge fitted in a socket, or otherwise attached to the stick or handle.

A reflector holder for lamps has been patented by Mr. Daniel R. Williams, of Dallas, Texas. Different forms of clamp and clasp are so made that the reflector may be held in any desired position, and may be turned around the lamp as desired, while yet it will be firmly held.

A device for attaching and detaching horses has been patented by Mr. Cicero C. Ferrill, of Shubuta, Texas. It is intended to make it possible to dispense with the ordinary harness except a collar and a pair of hames, and for this purpose the thills have ferrules and spring actuated pins, and the hames have specially contrived loops and guards.

A watch protector attachment has been patented by Mr. Julius C. Grimmell, of Brooklyn, N. Y. The invention consists in a casing with two swinging stirrups, thrown from each other by springs, and from the free ends of which a hooked fork is suspended, the stirrups preventing the withdrawal of the watch from the casing.

An extensible clasp for books has been patented by Mr. Jacob Monch, of Offenbach-on-the-Main, Germany. The clasp is formed of two plates, one adapted to slide under the other, the lower one having a diagonal slot, into which a stud of a nut or block passes, so the clasp can be easily lengthened or shortened according to the thickness of the book.

A fountain pen has been patented by Messrs. Albert J. Kletzker, of New York city, and Charles H. Court, of Jersey City, N. J. The pen has a point section with an aperture below the pen, the aperture being closed by a loosely fitting plug with a tongue, and adapted to be vibrated by the pen during writing, and thus cause a flow of ink.

A saddle seat has patented by Mr. Peter B. Hirsch, of Denver, Colo. This invention consists in dispensing with the bridge plate and the layers of leather, and employing in lieu thereof a single plate of metal shaped in dies to the desired form, and thus "building up" on the saddle tree a seat of such shape as wished.

A thill coupling has been patented by Messrs. Lorenzo D. Rundell and Perry Van Valkenburgh, of South Westerlo, N. Y. The invention consists of an axle clip with two projecting jaws or lugs, each having inwardly projecting flanges on the ends, a fork being secured on the inner end of the thill, and having a recess in each side edge of the front prong.

A pocket knife has been patented by Mr. George Freund, of Durango, Colo. It is designed for miners' use, to facilitate the cutting and capping of a fuse; the knife has a notch in the handle case and one in the blade, the latter having a screw thread formed on its bottom to press a screw thread in the end of a fuse placed in the notch in the handle.

A clothes hanger has been patented by Mr. Louis Barkany, of Baltimore, Md. The hanger consists of a notched arm with a cross bar hinged at its free end, and a prop supporting the arm, the arm and prop being pivoted to a support, the contrivance being especially adapted to hold clothes open, while it can be folded compactly when not in use.

An umbrella and parasol rib has been patented by Mr. Asher T. Meyer, of New York city. The rib is made hollow, and re-enforced at its outer end by a bar, with a head and flattened portion, and having an eye passing through both the rib and bar, the object being to simplify the construction of the lower or outer end of the paragon rib.

A pendulum scale has been patented by Mr. Henry C. Keeler, of Ogden, Utah Ter. This is an improved form of weighing scales in which pendulums with removable weights may be substituted for the balancing ball and weight, or the construction may be such that one of the beams and dials may be graduated for the scoop and the other beam and dial for the platform.

A flying target has been patented by Mr. Charles F. Stock, of Peoria, Ill. Combined with a fragile ring, having a flange on its lower inner edge, is an infrangible carrier ring, to be inserted within the fragile ring, and held there by the flange, so the fragile portion will break more easily than solid targets, and there will be no failure to indicate a well directed shot.

An automatic winding signal for spring clocks has been patented by Mr. Edward Jungerman, of Gettysburg, Pa. The invention consists in combining with the main spring of a clock a shoe or yielding bar, which, when the spring expands from uncoiling, is struck by the spring and made to bring a signal into view, on the face of the clock or elsewhere, to give notice that the clock should be wound.

A hame clip has been patented by Mr. Charles W. Massenheimer, of Allentown, Pa. The invention consists principally in making the clip with a hook and hinged tongue or section, the hook being made integral with the side plates of the clip, the side plates being joined with a solid shoulder or bridge at their forward ends, so the traces may be easily attached and detached without ripping the tug.

A lumber rack has been patented by Mr. Joseph A. Aycock, of Whitesburg, Ga. The rack is formed of a series of vertical sticks held movably between top, bottom, and intermediate pieces of a frame, between which vertical sticks the planks or pieces of lumber are held a distance apart equal to the thickness of the stick, thus permitting the air such access as will season the lumber in a short time.

A churn has been patented by Mr. Anson M. Otis, of York, Neb. The churn body has a projecting screw at the center of its bottom, and a stationary shaft with a radially expanding and contracting dasher connected by hinged bars, a sliding tube, and a pitman with a crank shaft, gear wheels, and a hand crank, so the dasher is expanded and contracted radially by the revolution of a crank shaft.

A wiping and polishing apparatus for plate printing machines has been patented by Mr. Alexander Reid, of Brooklyn, N. Y. Combined with the reciprocating bed of the press is a roller having slots, webs, paying off spools, receiving spools, and means for rotating the spools and vertically reciprocating the roller, the whole being an improved device for wiping off surplus ink and polishing the plate before taking an impression.

A mercury vacuum pump has been patented by Mr. Charles G. E. Neveux, of New York city. A bulb is made near the top of one of two vertical pipes united at their upper end, this bulb having valves arranged to connect it with the vessel to be exhausted; then by a special construction the mercury can be made to drive all the air out of the bulb, when the valves will so open as to connect with the air vessel to be exhausted, and this operation can be repeated several times with little trouble, there being no loss of mercury, and the whole construction being simple and rapidly worked.

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Brass & Copper in sheets, wire & blanks. See ad. p. 286.

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Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 286.

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) T. M.—It is almost impossible to identify a fiber botanically without specimens of its leaves and flower. We presume that the fiber comes from a variety of nettle called ramie (*Urtica neva*).

(2) W. A. C. asks for a correct analysis of suint. This is a fat, greasy, substance which is washed off of sheep's wool while getting it ready for manufacturing. A. Suint, according to Fuchs, consists of:

Potassium sulphate	25	per cent.
" carbonate	44·5	"
" chloride	3·0	"
Organic matter	50·0	"
	100	

The amount of potash salts depends upon the soil on which the food of the sheep grows. Other things being equal, it has been found that the merino wool contains the greatest amount of potassium salts, ranging as high as 30 per cent.

(3) F. S. S. asks: What is the difference between common bone black (animal charcoal) and ivory black? A. Properly speaking, ivory black should be derived from burning ivory chips or dust, in distinction from bone black, which is obtained from bones; but we believe the commercial article in most instances is simply a better quality of bone black.

(4) A. O. writes: I had the handles of a fine alabaster vase broken in several pieces. Will you please inform me of a cement or glue that will unite the pieces? A. Use the following: Add half a pint vinegar to half a pint skimmed milk. Mix the curd with the whites of five eggs well beaten, and sufficient powdered quicklime sifted in with constant stirring, so as to form a paste.

(5) Mrs. L. F. D.—Brass work can be polished by rubbing the metal with finely powdered tripoli mixed with linseed oil and applied with a rubber made from a piece of an old hat or felt. Or else a mixture of glycerine, stearine, naphthaline, or creosote mixed with dilute sulphuric acid can be used.

(6) L. M. W. writes: I have a very expensive linoleum carpet on my office, which is mopped every day, but soon becomes dingy. What can I varnish or coat it with which will stand a good deal of wear, and look bright all the time? A. Rub the oil cloth every two or three months with boiled linseed oil; rub it well in with a rag, and polish it with a piece of silk. Or else as it becomes hard rub it well with a small portion of a mixture of beeswax softened with a minute quantity of turpentine, using for this purpose a soft furniture polishing brush. In cleansing the oil cloth do not use soap or hot water.

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(7) T. F. asks the difference between quicklime and common building lime. A. Lime or quicklime is obtained by burning calcareous stones in kilns or furnaces. It is the anhydrous calcium oxide, or oxide of lime. This when exposed to the air absorbs water, and crumbles into a powder, which is commonly known as slaked lime, or hydrate of lime. The latter is chiefly employed in the preparation of mortar for building purposes.

(8) H. D. P. asks for receipt for lacquering tin different colors. A. The following will probably meet your desires: Put 4 ounces best gum gamboge into 32 ounces spirits of turpentine; 4 ounces dragon's blood into the same quantity of turpentine as the gamboge, and 1 ounce annatto into 8 ounces of the same spirit. These three mixtures should be made in different vessels. They should then be kept for about two weeks in a warm place, and as much exposed to the sun as possible. At the end of that time they will be fit for use, and any desired tints may be obtained by making a composition from them with such proportion of each liquor as the nature of the color desired will point out. Or the coloring matter may be produced by dissolving any suitable aniline color in alcohol, and adding it to the conventional tin lacquer.

(9) C. A. N. asks the best method of reducing the precipitate to metallic silver, as the methods that he is familiar with fail to give good results. A. The silver is reduced by either evaporating the bath to dryness and then treating the residue, or by precipitating the silver by means of dilute hydrochloric acid or salt solution; in either case the residue is poured in a crucible with equal parts of borax and carbonate of soda. The metallic button which will form at the bottom of the crucible will be silver.

(10) R. P. B. writes: I have two boilers 15 inches in diameter, 8 feet long, three 3 inch flews in each. Fire box 3 feet by 2 feet, return flue; it won't draw the flames in the flues, and not the length of the boiler sometimes. The stack is 8 inches in diameter, 20 feet high above boilers; the ash pit door is 18x6 inches, close to the ground. What is the best to stop a leak in a boiler? A. If the fire box you give dimensions of is for each boiler, you have not more than one-fifth the area of return tubes you should have, and of the smoke chimney (8 inches diameter) is for both boilers, it should be 17 inches or 18 inches diameter instead of 8 inches.

(11) E. E. P. asks: 1. What is the combination or commercial name, if any, of the metal which expands in cooling? A, Bismuth, cast iron, and antimony expand in cooling. The first mentioned expands one thirty-second in solidifying. 2. Is it chemically treated, or can it be mixed in any ordinary melting pot? A. Reference is made to the pure metal. 3. Does it lose this property of expansion by repeated heating and cooling if not melted? A. The property is not altogether constant; the molecular change brought about by repeated heating and cooling will, we think, interfere somewhat with its expansion. 4. Can you give its ratio of variation as compared with iron or steel? A. Its ratio of variation is greater than that of iron and steel, but we cannot give any exact figures on this subject.

(12) C. C. M. writes: I saw an instrument maker use a yellow substance put in a cotton cloth and dipped in water, for blacking banjo handles. Can you name it or something that will dye light wood black instantly? Would you give a receipt for a cheap and quick polish to be rubbed on with a pad? A. We infer from your description that you have reference to the following: Pour two quarts boiling water over one ounce of powdered extract of logwood, and, when the solution is effected, one drachm of yellow chromate of potassium is added and the whole well stirred. When rubbed on wood, it produces a pure black. Repeat with two, three, or four applications, till a deep black is produced. See also page 1994 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 125. Ground pumice stone mixed with linseed oil makes an excellent polish.

(13) F. De W. P.—Fluorine has never been isolated. The compound obtained was hydrofluoric acid. We would recommend you to avoid experimenting with fluorine, as the burns obtained with the compounds of this element are not only exceedingly painful, but also very dangerous.

(14) N. F. of Australia wishes to know the best dye for the hair. A. The least objectionable article is probably made from green walnut shells. Only the outside green portion should be used, cut small, and macerated for three or four weeks, then pressed and filtered and put in a bottle with spirit at 56° o. p.

(15) M. B. C. asks: How many horse power does it require to manufacture one barrel of flour in one hour? A. It is usual to allow one horse power per bushel of grain per hour, for the power required to grind the grain, and an additional horse power for driving the balance of the machinery of a flour mill. To simply reduce the grain required for a barrel of flour, to chop, in one hour, say five bushels, would therefore require five horse power. The conditions vary so much, that no exact rule can be laid down.

(16) J. E. B. writes: We cannot find an article that will thicken oils without destroying the lubricating qualities. A. We would suggest powdered graphite.

(17) A. S. asks at what rate light travels. A. About 185,000 miles a second.

(18) R. M. C. asks: Is the gas made from gasoline and generated by the Springfield gas machine as strong, when used for producing power in a gas motor, as the ordinary coal gas or that made from petroleum? A. It is used in some of the gas motors, and appears to be as "strong" as other gas.

(19) R. H. J. asks how the wires on the armature of the Brush machine are connected to the commutator. Are both terminals of each bobbin connected to the commutator, or only one? A. One terminal of each bobbin is connected with the commutator, the other terminal being connected with that of the bobbin located on the diametrically opposite side of the armature.

(20) H. K. G. asks: 1. The main school building there is 18 rods from the primary, and is heated by a 14 horse power boiler which will heat it well with 20 pounds steam. Is it practicable to heat the primary also, and in what manner? A. If your boiler is below the area to be heated, all you need do is to convey the steam to the primary and return the drip water in well protected pipes. If the boiler is above any of the rooms to be heated, a steam trap must be employed to let off the water or return it to the boiler. 2. What is a cheap mode of making a cylindrical or plate electrical machine? A. Consult the back numbers of the SUPPLEMENT. You will find in them descriptions of a number of machines.

(21) H. H. W. writes: I have a thermostat placed over a gas burner. The electrodes are of steel and brass, brazed. I want some metals which will heat and cool more quickly, *i. e.*, I want the thermostat to act more quickly. If you cannot suggest better metals for the purpose, can you suggest a simple method of cooling these more quickly? A. You can employ a very thin strip or wire of brass and multiply its expansion by levers, such a strip may be made to heat and cool very rapidly.

(22) C. G. asks for a non-poisonous liquid glue to take the place of a gum arabic mucilage, one that will not thicken in bottles when cold. A. Fill a glass jar with broken up glue of best quality, then fill it with acetic acid. Keep it in hot water for a few hours until the glue is all melted, and you will have an excellent glue always ready.

(23) J. E., Jr.—The answer was intended for you. You must adapt your battery to the purpose for which you use it. If you want to run single incandescent lamp, you must use a large number of cells connected in series. If you take the current through a small resistance, the battery will run down very quickly.

(24) M. I.—You can deaden the noise between rooms by nailing wall strips on the side of the beams and filling in with boards, and plastering with common mortar about two inches thick on top of the board filling. You will have to take up the floor to do this. You may accomplish the same thing by lathing between the beams from below, and plastering. Then lath and plaster upon the face of the beams, making two thicknesses of plaster. A second ceiling will answer the same purpose if you do not wish to disturb the ceiling or floor. This can be put on by nailing wall strips to the ceiling, and lath and plaster. Another way is to lay an entirely new floor with a second set of beams above the original floor, beams not touching the old floor.

(25) J. J. L. asks for information concerning the manufacture of milk sugar from the whey which is produced in cheese factories. A. Milk sugar, or lactine, is largely manufactured in Switzerland. It is also made in the United States to a limited extent. The process is, to strain or filter the fresh whey to remove all traces of curd. Then evaporate in pans at a moderate temperature, 150° to 175° Fah., until crystals begin to form, place in the pans small clean sticks for facilitating the process while the liquor is cooling. Let the cooling be carried as far as possible without freezing. Then draw off the liquor, and wash the crystallate with clear cold water by placing in a filter cloth and sprinkling the water over the crystals just enough to wash off the whey. Spread the crystallized crude sugar upon cloths to dry. For purification and bleaching, dissolve the crude sugar in boiling water considerably under saturation, and filter, through animal charcoal (bone coal), and also through a cloth filter, to remove all traces of bone black. Evaporate the filtrate at 150° to 170° Fah. to saturation, continuing the evaporation under a lowering temperature until the entire crystallate is deposited. Use small sticks of wood, preferably willow, to facilitate crystallization. Draw off the liquor, and dry on linen cloth.

(26) T. D. writes: I have a rubber thrashing belt 6 inches wide and 125 feet long, 4 ply. Will a 5 or 6 ply 5 inches wide, same length, give as much power as the 6 inch? I would like to use as narrow belt as possible on account of the wind affecting it. A. The heavy 5 inch belt will transmit as much power as the light 6 inch belt. It must be also run proportionally tighter than the wide belt. The thick belt under the greater strain will not wear as well as the thin one. You may also find trouble with the lacing if a quick speed is used. The journals also suffer with very tight belts. Better make all the pulleys larger by 20 per cent and use a 4 ply 5 inch belt.

(27) C. P. asks what ingredients to use for stamping on dark and light goods, from paper patterns, that will not rub off. A. Raw starch with a very small portion of gum sugar or even cooked starch mixed with it, with enough water to make it pasty, will make it stick; for dark goods. The same mixed with indigo blue will make a good stamping mixture for white goods.

(28) P. J. F. asks: Can you inform me how to construct a small battery sufficient to use for plating in silver, nickel, etc.? Have heard the Leclanche battery was best for this purpose, that is, for plating small articles, such as buttons, knife blades, etc. A. Use a bichromate battery with porous cell. The Leclanche is not adapted to electroplating.

(29) A. H. D. asks: Have you any knowledge of a preparation, which if applied to paper will render an electrical current visible on the paper? I have tried the following: in nitrate of ammonia, ferricyanide, glycerine, gum tragacauth, and water, but it does not give the desired results, as the paper must be wet, or it will not produce a color. A. We know of nothing for this purpose that can be used dry.

(30) J. D. R. asks about the largest locotive in the New World—its weight, dimensions, when made, its running time, number of cars it draws, and where it runs. A. We believe the largest engines in the country are on the Central Pacific Railroad. Cylinder 19 inches diameter by 30 inches stroke, 8 driving wheels 54 inches diameter, weight in working order 123,000 pounds; built at railroad shops. Engines now building at the shops of same company: Cylinder 21 inches diameter by 36 inches stroke, 10 driving wheels 57 inches diameter, weight in working order 146,000 pounds.

(31) J. E. J. writes: I have been grinding lenses according to directions given in one of your SUPPLEMENTS, but find trouble in polishing. Is the rouge that comes prepared for the face the proper substance to use? (It is all I could get.) How long should the last emery used in grinding be suspended in water? How long should the operation of polishing a lens one inch in diameter last under ordinary circumstances? Would the lenses known in optical catalogues as cosmorama lenses if silvered one side be of any service as a reflector for a telescope? If so, would a 4 inch lens of 72 inch focus as a reflector have a focus of 36 inch lens, being doubly convex? Would it be achromatic? Could it be conveniently silvered by the process given in SCIENTIFIC AMERICAN of July 31, 1880? A. Face rouge is adulterated. Use the finest jeweler's rouge, which you may obtain from any jeweler or watch maker. The washing of the emery for fine grinding is very difficult. It should be washed from the finest flour emery. Place a pound in a glass jar (preserve jar), fill it with water, stir gently with a small stick made like a paddle, allow a little water to trickle into the jar, let the top scum run away, set the jar in a dish, and slowly stir while the water is running into the jar. From the pound of flour emery, wash over about one ounce for the finest. Then in another dish about two ounces for the next finest. The balance will be useful for a third quality. The time required for polishing a lens of 1 inch diameter depends entirely upon the fineness of the last emery finish. Half an hour to two and a half hours may be required. A cosmorama lens is unfit for an object glass or a reflector, and will not be achromatic in either case. It can be easily silvered, as stated in SCIENTIFIC AMERICAN.

(32) W. McC. asks if there is anything better than a boom derrick for hoisting a weight, say two tons. I want to swing it in a radius of twenty-four feet from the corner of a wooden building that is not over twelve feet high. We have plenty of steam power to work with, and would like to get something cheap. A. We doubt if you can do better than to use boom derrick. It is made with a mast, and a braced boom for lightness, using two sets of tackle for swinging in or out from the center. Drawings of a 30 foot hand derrick, which we think would answer your purpose, were published in SCIENTIFIC AMERICAN SUPPLEMENT, No. 380.

(33) T. G. asks (1) how to make those wax crayons which are used to work one on top of the other without disturbing the under color. A. The wax crayons or pencils are made with paraffin or spermaceti, pipe clay, and the various colors. The clay must be white; just enough of the paraffin or spermaceti is used to hold the clay and colors, to be decided by experiment; we cannot give the exact details. They are manufactured and imported from France and Germany. 2. Also what is the composition used in making tiles or plates for coal burning stoves? A. Stove linings are fire brick or tiles made of fire clay.

(34) P. C. A. asks: 50 horse power Westinghouse engine using steam at 70 pounds pressure from 60 horse power, 12 flue boiler. Cylinder exhausts into a 36 inch by 8 foot boiler having twenty-four 3 inch flues ¼ inch thick, and a rotary exhaust fan in chimney opening. Would the air drawn through the flues by the fan be sufficiently heated for economical use in a lumber dry house? A. According to your statement, we doubt the economy of your proposed arrangement. The temperature of the air delivered by the fan would be too low for rapid drying. If you can give ample time for drying, the arrangement will work well, and the effect on the lumber better than drying very rapidly.

(35) F. A. W. asks the date and most important facts of the trial of horse power *vs.* locomotive, that took place in Baltimore, Md., nearly fifty years ago, with assistance of Mr. Peter Cooper. I lost the illustrated sheet he gave me. A. The trial took place on 28th of August, 1830, in a run from Baltimore to Ellicott Mills, distance of 13 miles, time one hour and 15 minutes; shortest time for any one mile, 4½ minutes. On the return trip, time was 61 minutes for whole distance. Shortest time for any one mile, 3 minutes and 50 seconds; one engine, 3¼ inch cylinder and 14¼ inch stroke. You will find full account in Brown's History of Locomotive in America.

(36) A. F. writes: I have a small vertical engine, 3x3; is it large enough to run a small boat? 1. How large a boat will it drive? A. With plenty of boiler, a boat 16 or 18 feet in length and 4¼ feet beam. 2. Can I drive direct on shaft, or will I have to gear off? A. Drive direct. 3. How fast would the engine have to run? A. 350 to 380 revolutions per minute. 4. What would the dimensions of boiler have to be? A. Boiler with not less than 58 square feet of heating surface.

(37) J. T. writes: A propeller engine cut-off cam is generally opposite the crank when on dead center. Now, what is the object in having it set behind the crank instead of the front? A. Probably to cut off later in the cylinder. We could not say positively without knowing the arrangement of your cut-off gearing.

(38) E. E. R. writes: If one has an engine (slide valve) larger than he needs for his work, which is the more economical—to take off pressure from boiler, or to keep the pressure as usual and slack the speed on the engine? And is there much difference between these two ways? A. Keep up the pressure, and arrange your valves to work more expansively, will be most economical. 2. And, taking any common slide valve engine run to its rated power and using a certain amount of fuel per horse power, what part more fuel (approximately) would it take per horse power when running the same engine to one-half its capacity? A. When running at one-half capacity, it will take a trifle more fuel per horse power, but the amount of difference will depend upon the surroundings, radiation of cylinder, pipes, etc.

(39) W. F. asks: 1. About how many and what kind of questions are asked in examination? A. We cannot say, as it is entirely with the examiners. 2. How many kinds of boiler iron are there, and what pressure will each kind stand to the square inch? A. There are various qualities of boiler iron made. Their tensional strength will run from 40,000 to 60,000 pounds per square inch. 3. How can a very small leak in a boiler, in the seams, be calked best without going to a boiler maker? A. By careful use of the calking tool. 4. How many square inches ought a boiler of the following size to contain: Six feet high, single flue, and about 3 feet in diameter? A. We do not understand your question about square inches in a boiler. 5. I have charge of a double piston engine, and hoist brick. I pull an average load of 500 pounds a trip. To do this I must carry between 70 and 90 pounds of steam. The engines are very powerful, though small, being 4x8. I want to make the engines do the same work with sixty pounds. A. You can only make the engines do the work with 60 pounds steam by changing gearing (if you have gearing) so as to increase the speed of the engines without increasing speed of drum. 6. What kind of oil is best? I use black oil. A. There are so many kinds of oil in market, that we cannot say which is best. 7. What is best to do, and how can a slipped eccentric be remedied immediately without losing time? A. Set your eccentric right and mark eccentric and shaft, so that if it slips you can set it in place by the marks.

(40) W. M. S. asks: Can an engine, having to draw its water, and thereby expending some of its own power, throw a more effective stream than when the water is forced into the pumps by outside forces? A. No; whatever pressure is thrown on the suction by an outside force is so much relief to the power required to work the engine under similar conditions.

(41) Azof, of Russia, writes: 1. *a.* I am putting down a cupola, using an old boiler shell, 3 feet 6 inches diameter; inside measure after lining will be 2 feet. I have two rows of tuyeres, 15 in each row, 4½ inches by 3 inches, made by leaving out third brick in each row. What wind shall I require to work most advantageously? *b.* How much iron ought I to melt per hour? What should be the charges? Fuel anthracite. *c.* I have an English fan 25 inches diameter with 12 inches round discharge, calculated by the maker to run down 3 tons per hour at 2,500 revolutions. With this fan I wish to blow cupola and three smiths' fires. What speed should the fan have for smithy and cupola together, and what speed for smithy alone, and what arrangements of tubing would suit? A. *a.* A pressure of 7 or 8 ounces per square inch of coke is used, and with coal 12 to 16 ounces. *b.* Average not over 1½ tons per hour with your dimensions of cupola. This may be increased by careful manipulation to 2 or 2½ tons. Your blower is sufficient for three tons if the cupola were large enough. *c.* Your fan is ample for both cupola and three forge fires; 2,500 revolutions will be fast enough for all your work, and might be reduced one-quarter or one-third when forge fires only are in use, but the blast to fires should be regulated by a valve at or near the forge. 2. In using emery wheels, should the upper side of the wheel run to or from the workman? A. Run top of emery wheel from the workman. 3. What will be the horse power of a horizontal engine whose cylinder is 9½ inches by 16 inches, revolutions 95 per minute, and will a boiler with one flue only 14 feet 6 inches by 4 feet 3 inches be large enough for this engine? A. With 50 pounds average pressure on piston, 21 horse power. If fired underneath shell and return through flue, it would answer; but if the furnace is inside the flue, it is too small. It would be better if increased in length 4 feet or 5 feet. We think you have at least three times the amount of tuyere opening into cupola that you should have, though in this respect much depends upon the kind of fuel. In respect to charging, we cannot advise you, as much depends upon shape and height of cupola and character of fuel. We recommend you to obtain a copy of Spretson on Casting and Founding, published by Spon, London, and West on American Foundry Practice. They will give you much information on the subject.

(42) S. F. H. asks: 1. What is the size that book binders use for putting on gold leaf? A. It is albumen, the white of an egg. 2. How is an electrotype made from a relief plate in photo-engraving, or is the electrotype made from a plaster cast, and how? A. A wax mould is taken from the relief plate, and then covered with very fine plumbago by means of a brush or air blast. The copper is deposited on the plumbago by means of a battery. When the shell is sufficiently thick, it is removed from the wax and filled in at the back with type metal.

(43) G. H. J. asks: 1. Will 3 cells of the Law battery answer for plating small articles, say a watch case? A. Better use a continuous current battery, like the Daniell or gravity. 2. Can I increase the power by using larger zincs? A. Not to any great extent in the battery referred to. 3. Can I increase the intensity by using some other liquid in the place of the salammoniac solution, and at the same time make the battery more constant? If so, what liquid? A. Better use some other form of battery.

(44) L. P. Jr., asks (1) if there is any cement that can be used on glass and is not soluble in bisulphide of carbon. A. Gelatin dissolved in acetic acid makes a cement insoluble in bisulphide of carbon. 2. Also, if there is any way to insulate a steel magnet so that it will retain its strength, if inserted in a piece of cast iron? A. There is no way to insulate the magnet.

(45) H. R. E. asks (1) how many cells of the plunge bichromate battery, size of carbons and zincs 3x6 inches, I require to produce incandescence in a lamp similar to Edison's? A. Six cells will operate a 3 candle incandescent lamp. 2. Also, how to make a medical magneto electric machine for family use? A. Consult any work on physics or electricity, or the back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT. The subject is too extensive for our Note and Query columns.

(46) A. J. N. asks how the supersaturated solution of bichromate of potassium is made, the same as is used by M. G. Trouve in his illuminated jewelry? A. Dissolve bichromate of potash to saturation in hot

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water. Let the solution cool. When the sulphuric acid is added, the solution will become hot, and redissolve most of the crystals formed on cooling.

(47) W. K. R. writes: Supposing that a man had the power to fly through space at the rate of 1046·55 statute miles per hour, in same direction that the world revolves, starting from New York city at 12 M., and having flown one hour, would stop and ask what time it was, would he not get the reply that it was 12 o'clock? He flew another hour, and asked the time; he was told it was still 12 o'clock, and so on until he came to his starting point, New York. He has traveled all through day time, but when he gets to New York he is told a night has passed. How do you account for the day gone by and the difference in time? A. As you have put the proposition, why not place the man on top of some high steeple? In this case he will be passing through space at a rate of 1046·55 miles an hour in same direction as revolution of earth. His relation to objects below him will remain unchanged, but his relation to time will be ever changing. It will be midday when he is on the nearest approximate side to sun, and midnight when he is in exactly the opposite face of earth. If, however, he flies at rate stated in opposite direction of rotation of earth, which is probably what you wish, he will remain on midday line, while the earth will be rotating constantly below him. During the mean time it is New York or any point from which he may have started which has found the midnight line, and which therefore counts one day as having elapsed.

(48) S. A. R. asks: 1. What is the power and probable cost of a dynamo capable of running a dozen incandescent lamps? A. Probably $200. 2. What power of motor would be necessary for running such dynamo? A. 1½ to 2 horse power. 3. What size lamp is most suitable for an ordinary sized dwelling, more than one lamp per room being preferred? A. 15 candle power.

(49) G. W. L. asks (1) how to change the surface of iron and steel to a black color. A. See answer to query 48 in SCIENTIFIC AMERICAN for March 29, 1883. 2. Is there anything that will protect finished iron from rusting? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 226, for recipes of Varnishes for Protecting Iron.

(50) G. P. W. asks how to treat fence posts to make them last longer in the ground. Some boil in coal tar, others char the ends with fire, others say put the top end down. A. We would recommend the coal tar treatment, and why not at same time put top end downward? You would then have a very good combination. 2. I want a recipe for an embalming fluid, to use as an undertaker upon human bodies. A. See A New Method of Embalming Bodies and Preserving Tissues, page 69, SCIENTIFIC AMERICAN, for February 4, 1882. Also, Brunelli's Process of Embalming, page 169, SCIENTIFIC AMERICAN, March 18, 1882, and Embalming in Italy, page 52, SCIENTIFIC AMERICAN, July 22, 1882.

(51) W. H. writes: 1. When celluloid collars have been worn a short time, they turn yellow. Can they be restored to their original color? A. If the coloring does not disappear when the affected portions are rubbed with a woolen cloth and a little tripoli, and then polished with a clean woolen rag, the injury is a permanent one. 2. How are the sticky fly papers made that are sold by drugstores? A. Boil ¼ ounce small chips of quassia in 1 pint of water, and add 4 ounces glycerine. 3. What metal is it that mixed with tin prevents it turning lead color, but makes it look whiter and more like silver when the article has been used some time? A. An imitation of silver is made by combining 3 ounces tin with 4 pounds copper. So that it is possible that by adding copper in suitable quantities the desired result will be obtained.

(52) R. S. B. writes: 1. I want to make caustic soda liquor for boiling goods. I know that carbonate of soda boiled in lime and allowed to settle will produce the liquor. What is the best way to do this? A. The most convenient way for you will be the best way. It is immaterial in what kind of vessel the operation be performed. 2. Will the liquor be as strong this way as by putting in 70 per cent soda? A. We believe it will be. 3. Will it be free of lime, as the lime will spoil the goods I want to cook? A. Unless exactly the right amount of lime is used to satisfy the sodium carbonate, there will be danger of an excess of lime. To obviate any difficulty of this sort, the utmost care must be used to employ the proper proportions of each.

(53) R. B. R. writes: In my letter to you suggesting what seemed to me to be the natural arrangement of the colors of the spectrum as applied to the musical scale, the order of colors should have been reversed in the list given, so as to read:

Notes.	Colors.	Sound vibrations.	Light vibrations.
A	Red	106⅔	458 trillions.
B	Orange	120	506 "
	Semitone.	Semitone.	Semitone.
C	Yellow	128	535 "
D	Green	144	577 "
E	Blue	160	622 "
F	Indigo	170⅔	658 "
G	Violet	192	727 "

The vibrations per second in this list increase in the same direction; and you will observe that the difference in both series of vibrations between B and C shows the semitones. This is evidently no accident on the part of nature, but clearly an indication that she intended we should study sound music and color music in connection, and not as separate arts. Will you kindly inform me how I can obtain seven distinct transparent shades of each color? I cannot get the information from the painters. Would gelatine paper enable me to do it? A. Your investigation, if novel, is an extremely interesting one. We would suggest that excellent effects may be obtained by coating glass with ordinary shellac varnish (made with bleached shellac) tinted with aniline dyes. The dyes you can easily select of the shade that seems to you most desirable. The glass must be slightly warmed before applying the varnish. The strongest alcohol should be used for dissolving the shellac and the powdered (not liquid) aniline colors. One part of shellac to eight of alcohol is a good proportion. The varnish should be poured on and placed evenly over the glass, and the superfluous quantity returned to the bottle. It must not be painted on.

(54) L. V. T. writes: 1. I send a piece of wall paper, and would like to know if there is any arsenic contained in the green color, and what are the symptoms of arsenic poisoning? A. The green spots on the paper are so small and so few that we think there is very little danger of poisoning from this source. To determine the quantity of arsenic in the wall paper sent, a chemical examination would be necessary. The symptoms of arsenical poisoning, according to Taylor, are first faintness, depression, nausea, and sickness, with an intense burning pain in the region of the stomach, increased by pressure. The pain in the abdomen becomes more and more severe, and there is a violent vomiting. In chronic cases there will be inflammation of the conjuctivæ, with suffusion of the eyes and intolerance of light; also with more or less irritation of the skin. 2. Can you tell us of a substance to mix with Portland cement that will set middling quick and stand weather, and become hard and durable? Sharp sand and Portland cement with plaster of Paris, we have tried, but the plaster freezes and swells in winter and bursts the socket. Is there anything we could mix with the sand and cement to improve it? A. The following cement will probably suit your wants: 63 parts well burned brick and 7 parts litharge pulverized and moistened with linseed oil. Moisten the surfaces to which it is to be applied. Also see article on Cements, page 2110 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 133.

(55) W. R. S. asks whether or not any one has succeeded in photographing in natural colors. If it has been done, what was the modus operandi? A. Not very successfully. See back Nos. of the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT for information. We send you catalogue. 2. In SUPPLEMENT No. 149, under the heading Simple Electric Light, four or six bichromate cells of the size given are said to be necessary. Would a single cell, four or six times as large as the one recommended, answer the purpose just as well? A. No. 3. Where, and by whom, is the *Chemical News* published? A. Editor, William Crookes, Boy Court, Ludgate Hill, London, Eng.

(56) W. L. T. asks: What is crocus? A. The term, as employed in the mechanic arts, usually refers to a preparation of the oxide of iron used for polishing metals and gems. But the term is generic and not specific, and means, from the Greek, "saffron," a color. It is applied also to an oxide of copper and an oxide of antimony.

(57) D. S. asks: 1. Are all kinds of small castings made to any extent direct from the Bessemer converter into the ordinary sand moulds? If not, why not? A. Bessemer steel demands so high a heat for fluidity sufficient to pour small castings that ordinary sand moulds will not contain the metal in shape. Ground silica is used for Bessemer steel moulds. 2. As I understand, malleable castings are simply ordinary castings put through a process to extract a part of the carbon. If this is so, and the Bessemer converter decarbonizes the fluid metal to begin with, why should not all kinds of castings be made direct into sand moulds from the converter? A. The material of Bessemer steel and that of malleable cast iron is radically different, fully as much so as brass and bronze, or lead and Britannia metal. Not only is the resultant material different, but the materials of the compositions are different. Treatment appropriate to the one is entirely unfitted to the other.

(58) N. D. T. asks for a recipe for making soap bubbles, such as are used for chemical experiments. A. One gramme dry Marseilles soap is dissolved in 100 grammes warm water; this is filtered, and to every 100 cubic centimeters of this solution 40 grammes white sugar is added. Bubbles made with this liquid will last several hours.

(59) E. S. A. asks how the cement is manufactured, or where I can obtain it, which is used to paper iron pulleys to prevent the belts from slipping? Also the kind of paper used for the same. A. Use hard wrapping paper and glue. Roughen the surface of the pulley with a coarse file. Then draw the paper tightly around the pulley, brushing the glue quickly upon the pulley and upon the paper, so that every layer will be perfectly glued together; put on eight or ten thicknesses.

(60) E. D. L. asks if there is any preparation that you can put on a wall that has been whitewashed, to make paper adhere to it, and thus avoid the trouble of scraping the walls. A. The whitewash must be scratched with a stiff brush, to remove every particle of loose lime from the surface, after which it should be thoroughly swept down with a broom and then coated with glue size prepared by breaking up glue into small pieces, putting them in a vessel with sufficient cold water to just cover them, and in the morning the glue will be soft enough to melt readily with a moderate heat; then reduce to desired consistency by adding suitable amount of water.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Mrs. J. A. H.—The mineral is simply a very pretty piece of crystallized quartz, and is of no value except as a curiosity.—E. A. B.—Realgar is found principally in Europe, in Austria and in Saxony. It is valuable as a mineral, being worth 25 cents to $2.00 per specimen. The ease with which it could be produced artificially would prevent it from ever becoming commercially valuable.—A. O.—The specimen appears to be clay colored with oxide of iron or decomposed iron ore. Its nature cannot be positively determined unless it be chemically examined.—L. F. K.—The brown specimen is a close grained silicious material colored by iron, and is of no value as an ore. The other specimen is hornblende and mica.—G. A. S.—The specimen is simply clay (aluminum silicate) colored with a little iron oxide.

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April 22, 1884,

AND EACH BEARING THAT DATE.

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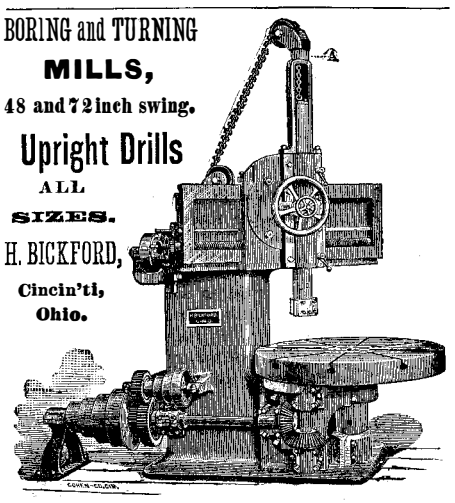

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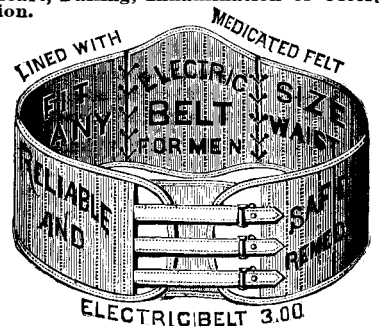

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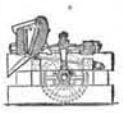

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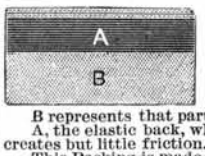

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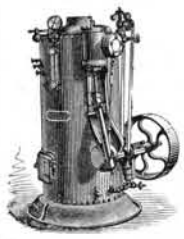

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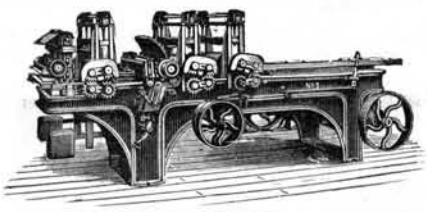

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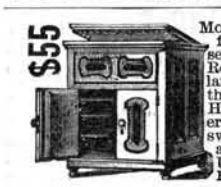

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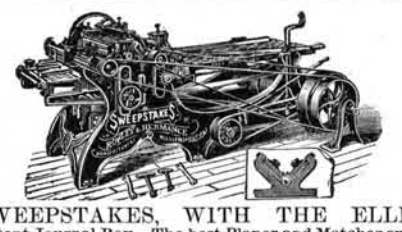

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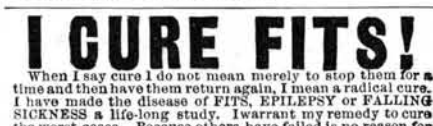

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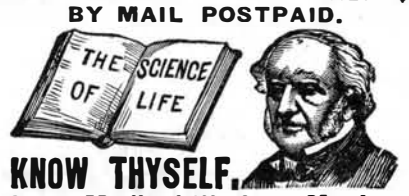

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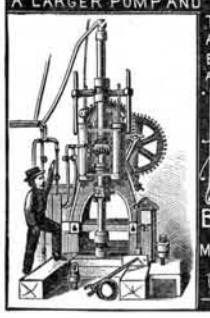

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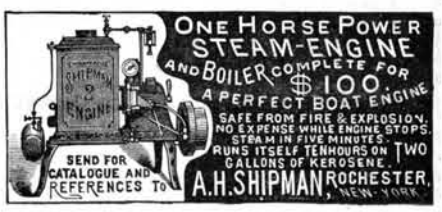
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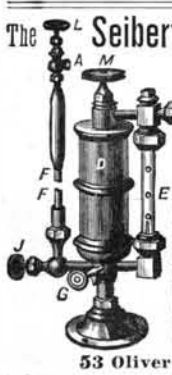

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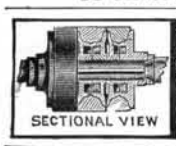

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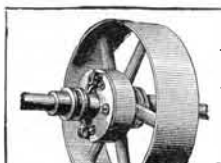

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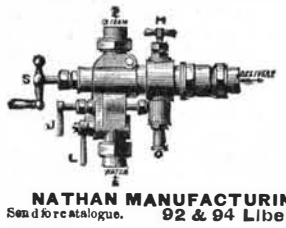

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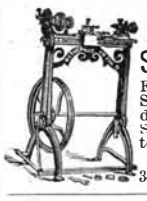

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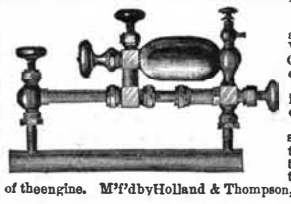

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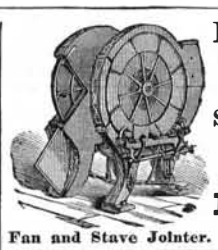

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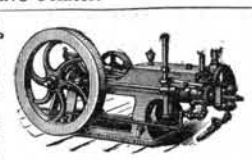

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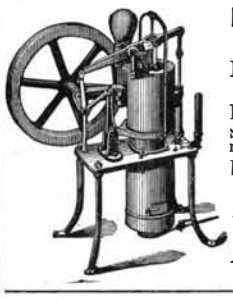

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